Maid Labs Technologies

VOLUCALC™ VS

User Manual

Constant and Variable Speed Pump Flow Meter
Installations also include:
Level Monitor and Open Channel Flow Meter

August 2013

IMPORTANT:

READ THE MAIDDEVICES CONFIGURATOR BEFORE INSTALLING AND USING THIS DEVICE

SEE PAGE 34

Registration

Thank you for purchasing the VOLUCALC™ VS. Please complete and return the registration form.

The internal software for the products manufactured by Maid Labs Technologies can be updated easily.

By registering this software you will be able to enjoy the majority of upgrades we will make over the years in firmware, provided that your hardware is compatible. To access the updates, you must provide the following information (make a photocopy of this page) fill the form below and then return it to us via mail or fax, or simply fill out the Registration section on our website www.maidlabs.com

Our services and guarantees are only available for registered products.

If you have several products, please register them all.

Name: _____

Email : _____

Organization : _____

Address : _____

City : _____

Province/State : _____

Postal Code: _____

Name of Product : _____

Serial Number : _____

Date of purchase : _____

Warranty

MAID Labs Technologies Inc. (hereinafter called "MAID Labs") states the following warranty for any new Maid Labs product, sold by our authorized representatives.

MAID Labs guarantees that this product, under normal use and maintenance is free of all manufacturing defects, and is subject to the following terms and conditions:

1. To obtain warranty service:
   (a) The product was registered within 30 (thirty) days from the date of receipt.
   (b) The registration form must be completed fully and returned to MAID Labs.
   (c) The product must be shipped to Maid Labs main office or to an approved maintenance and repair service center for repair or replacement. Shipping is at the customer's expense.
2. Limitations: This warranty does not apply to:
   (a) Repair or replacement of all cabinets, batteries, connecting wires, antennas and accessories.
   (b) Any defect or repair as a result of abuse, neglect, inadequate care and/or misuse.
   (c) Any defect or repair due to failure to follow the recommendations in the user manual.
   (d) Any modification, adjustment or repair to Maid Labs products by any other company other than Maid Labs authorized maintenance and repair centers.
   (e) All Maid Labs products, whose serial number has been damaged, altered or removed.
   (f) All Maid Labs products that are not the property of the original owner.
   (g) Products purchased from a bankrupt, insolvent or non-approved representative.
   (h) Any damages caused by fire, rain, flood, lightning, power surges or other events beyond the control of Maid Labs (acts of God).
   (i) The warranty does not cover the elimination of static or electrical interference, adjustments or costs of labor associated with removal or reinstallation of the unit for repair.
   (j) The warranty does not cover damage caused by high humidity, water or leaking/damaged batteries.
3. If a Maid Labs product is defective under applied conditions, necessary repairs will be performed, at no additional cost, for parts and labor where Maid Labs recognizes that such defects are caused by materials or manufacturing.
4. This warranty constitutes the entire expressed warranty given by Maid Labs for Maid Labs products. No representative or service maintenance employee is authorized to extend this warranty on behalf of Maid Labs
5. Since each installation may incorporate malfunctions, preventing Maid Labs from ensuring the smooth operation of its devices in all circumstances, Maid Labs will not refund nor exchange the instruments that were caused by connections to any problematic installation.
6. The warranty period is one year on parts and labor from the date of shipment.
7. LIMITATION OF DAMAGES: To the extent permitted by applicable law, under no circumstances MAID Labs or its affiliates be liable to you, to a user or a third party for any indirect, special, consequential, or punitive damages of any kind whether in contract or civil, including but not limited to, personal injury, loss of revenue, loss of goodwill, loss of business opportunities, loss of data, whatever may have been the predictability of such damages. And in no case may the total responsibility of Maid Labs or its affiliates exceed the equipment purchase price received from you, from a user or from a third party, regardless of the laws by which the cause of action was brought. The foregoing does not affect your territory's statutory rights.

At Maid Labs Technologies, we have made every effort to provide a user manual that is up to date and easy to use. However, it is possible that errors may occur, or recent hardware or software upgrades might not be in your manual. We strongly suggest checking our website to see if a newer version of the manual is available www.maidlabs.com

Table of contents

REGISTRATION 3

WARRANTY 4

TABLE OF CONTENTS 5

CONTACTS 7

PRODUCT APPLICATION 7

PRODUCT DESCRIPTION 7

OPTIONS / ACCESSORIES 7

DIMENSIONS 8

USE AND MAINTENANCE 9

- Environmental Conditions 9
- Cleaning 9
- Electrical Conditions 9
- Power and Batteries 9

INSTALLATION 9

- Power supply 120VAC/12 VDC 9
- VOLUCALC™ VS - Installation 12
- Digital input 13
- Communication 13

INSTRUMENT START-UP 13

THE MENUS 13

MAIN SCREEN 13

NUMBERS SELECTION SCREEN 14

MENU 1 15

INSTRUMENT SETUP 15

- Date & Time setup 16
- Units 16
- Display 17
- Inputs/Outputs 17
- Level setup 19
- Open Channel Flow (Overflow) Setup 19
- Open Channel Flow Equations (Overflow) 20
- Bandwidth setup 20
- Alarms setup 20
- Download settings 21
- Reset total events 21
- Firmware Upgrade 21
- Language 22
- Lock screen password 22
- Power Factor Setup 22
- Voltage Setup 22
- Phases Setup 23
- Pressure Override and Level Override 23
- Technician 23
- Factory Reset 24
- Delete File 24
- SD Card Info 24
- Copy Manual from USB 24
- Copy App from USB 24
- ScreenShot 24
- Inputs Calibration 24
- Raw Values 24

DEVICE INFO 25

IP INFORMATIONS 25

COMMUNICATION TEST 25

RELAY TEST 25

ANALOG OUTPUT TEST 26

LOCK SCREEN 26

SHUTDOWN DEVICE 26

RT 2 (REAL TIME) 26

- Real time 26
- Pump Statistics 27
- Power Consumption 27
- Internal Info 27
- Rain Statistics 28

INFO 3 28

USB 4 29

- Reports 29
- Copy User Manual 32
- MerMaid Data 32
- Technician Data 32

MAIDDEVICES CONFIGURATOR 33

- Welcome Window 33
- Options 34
- Device Details 34
- General informations 35
- Display options 35

Lift station 36
Inputs and Outputs 37
Fixed speed pump capacity 39
Pump Curve Selection 40
Pump Curve Editor 43
VOLUCALC™ VS Calibration worksheet 46
Level setup 47
Flow computation formulas 47
Contracted Rectangular Weir and Suppressed Rectangular Weir 48
Trapezoidal Weir (Cipoletti) 48
V Notch Weir 49
Manning Equation (Open channel) 49
Manning Equation (Partially full pipe) 50
Polynomial Flow Formula 51
Standard Flow Formula 51
Lookup table 52
California Pipe 52
Alarms 53
Communication setup 53
Save folder 54

ACCESSORIES 55
Ultrasonic Level Sensor (MLSU-05M & MLSU-10M) 55
Wastewater pressure level sensor (MLPL) 56
Pump Outlet Pressure Sensor (MLPS50, MLPS100 and MLPS300) 57
Current Sensor (MLCT75) 58
Current Sensors (MLCT150 and MLCT300) 58

INDEX 59

Contacts

MAID Labs Inc.
944, André-Liné, Granby, Québec, Canada, J2J 1E2, **T** 450-375-2144
Web : www.maidlabs.com Email : info@maidlabs.com

Product Application

Unless otherwise specified, this manual contains the information required to install, operate and maintain the VOLUCALC™ VS instrument and associated accessories.

Product Description

VOLUCALC™ VS is a derived flow based flow meter for constant speed and variable speed pumps.

When used with constant speed pumping applications, the installation of a current sensor per pump is required to record the operation of each pump monitored. The capacity of pumps and pump combinations (pump curves) are entered in the configuration software.

If it is an installation requires at least one variable speed pump to be monitored, then flow curves for a minimum of 2 speeds (RPM) are required for the variable speed pumps. This is achieved through with the Maid Devices Configuration software. The RPM of the pump comes from the analog outputs of inverters/drives. The calculated head pressure comes from the difference between the liquid level input and discharge-pressure or effluent pressure input of the station. VOLUCALC™ VS integrates the curves of all pumps and tracks the analog 4-20mA output proportionally to the resulting calculated derived flow.

Up to four pumps can be connected to VOLUCALC™ VS. When only two variable speed pumps are connected, the inputs of pumps 3 and 4 can record the current drawn of pumps 1 and 2. This allows you to evaluate their energy consumption more accurately. If 3 pumps are connected to VOLUCALC™ VS, then pump 4 input can be used to record the main current consumption. Energy consumption will be splinted proportionally. A rain gauge can also be connected, for infiltration studies.

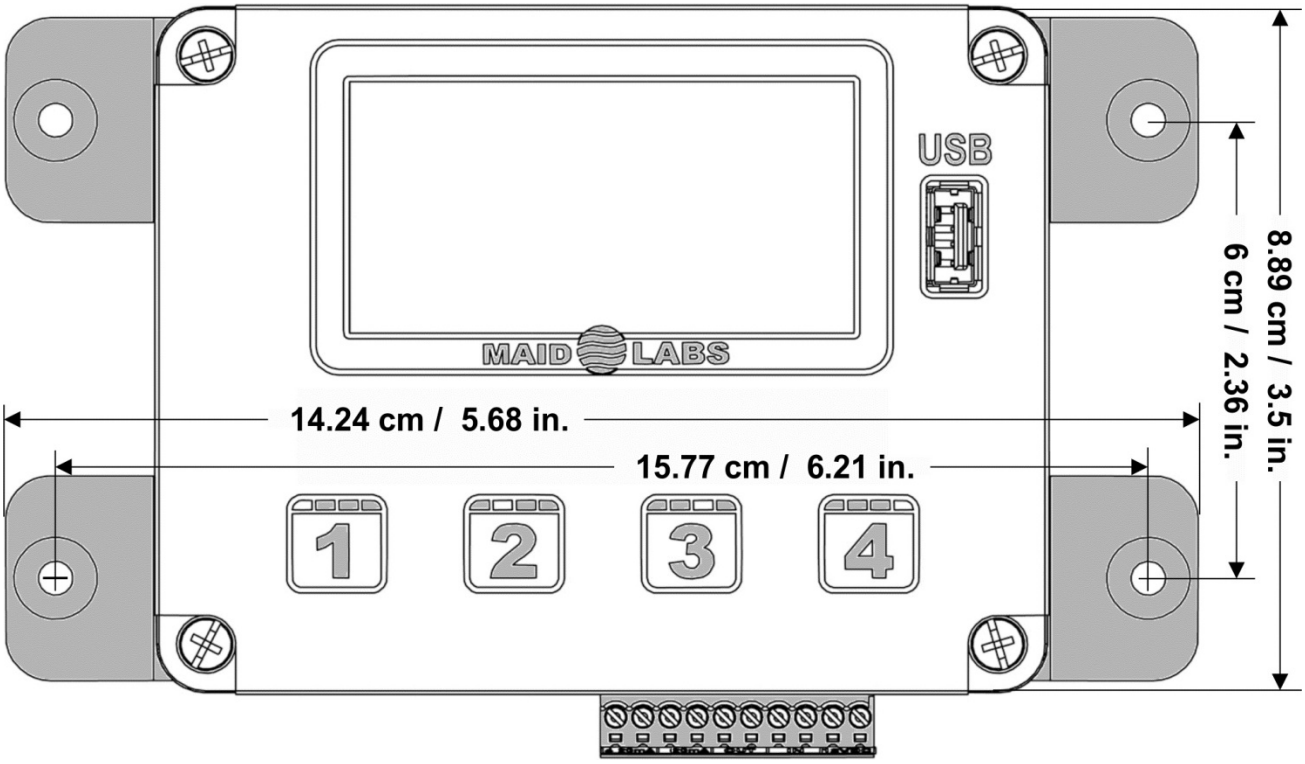
The VOLUCALC™ VS displays the flow rate and total volume pumped. A monthly Excel report with rainfall and volume pumped per day can be generated using the stored data and copied to a USB key. The instrument can store years of data. The data is be downloaded to a USB key or through the Ethernet port. The optional Mermaid software allows for a more detailed analysis of the data. The MaidMap geographical monitoring software displays real time information of all Maid Labs devices connected to the Internet through the Ethernet port.

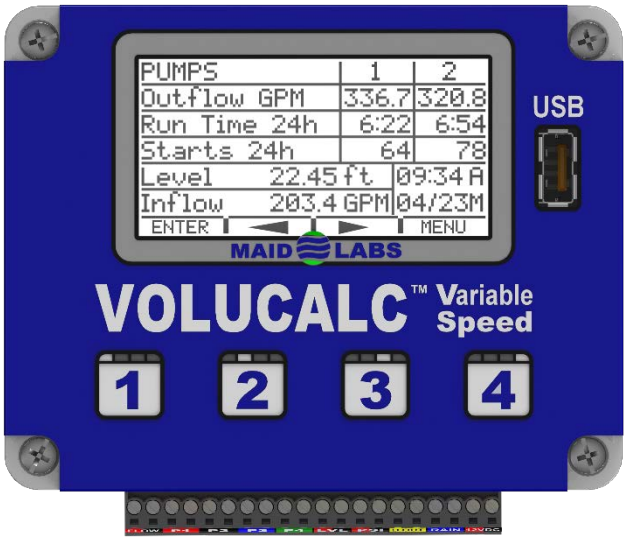
Options / Accessories

Power supply 120V – 12 VDC 2A **MLPS2**
Drying tube for level sensor
Rain Gauge NWS approved **MLRG1**
Cellular modem with Ethernet port **MLCELETH**

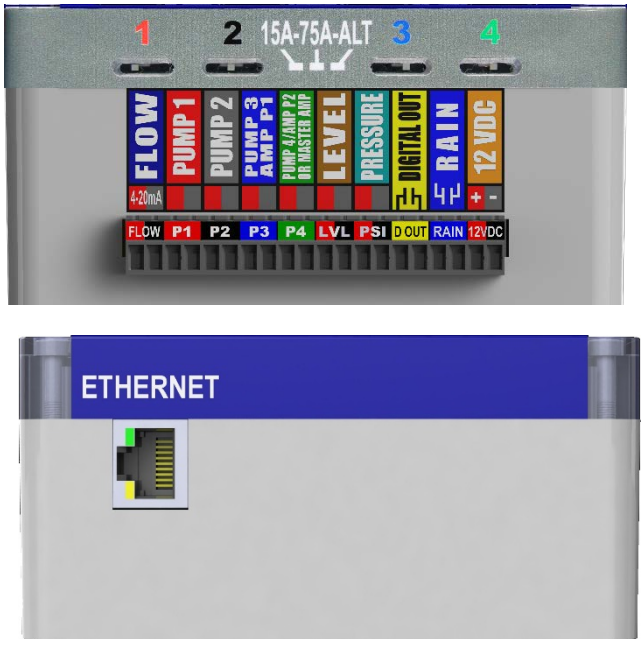
Level sensor by pressure for wastewater **MLPL**
Pressure sensor 50 PSI (**MLPS50**), 100 PSI (**MLPS100**) and 300 PSI (**MLPS300**) for pressure on the output of the pumps
Resistive level sensor **MLSNR**

Dimensions





Height 5.5 cm (2.2 in), Length 11.4 cm (4.5 in)



Length 11.4 cm (4.5 in), Width 9.8 cm (3.9 in)

When installing the instrument, provide enough space above it for the Ethernet port on the top, and below it for the connector and wires input.

Use and Maintenance

Environmental Conditions

It is the user's responsibility to ensure that this product is not exposed to an environment for which it is not designed. These conditions may include a range of extreme operating temperatures, high humidity, vibration or abnormal shock, submersion or potentially explosive atmospheres.

Cleaning

Periodic cleaning is recommended for the sensors to prevent fouling and insure they are providing the correct data. It is important to follow the sensor manufacturer's recommendations.

Electrical Conditions

Each Maid Labs product is designed to operate correctly within a specific range of electrical conditions. The product label identifies the main parameters for all connections. All input connections are designed to resist reverse polarity, as well as higher voltage to a certain extent. It is the user's responsibility to ensure that all electrical connections are made in accordance with the recommendations of MAID Labs and the local electrical code. **The user should read this manual before connecting the device.**

Power and Batteries

This product works "ONLY" with internal rechargeable batteries, size C, and an external 12 VDC power supply**. DO NOT INSTALL NON RECHARGEABLE BATTERIES INTO A DEVICE THAT CHARGES BATTERIES, AN EXPLOSION MAY RESULT**. All types of batteries may leak, and this may cause damage not covered by the warranty.

Installation

The VOLUCALC™ VS is not waterproof. Avoid placing it in wet locations where liquids could inter the product or condensation is a problem. Damage caused by water or excessive humidity voids the Maid Labs warranty.

A desiccant bag is placed inside the instrument in order to minimize or delay damage related to humidity that effects all electronic products. When you open the case to change the batteries, be sure to replace the desiccant bag. If you think it is inefficient, you can order additional desiccant from Maid Labs.

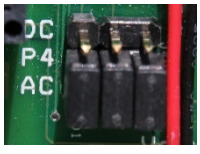
The instrument must be placed in a location where there is no risk of being hit or dropped.

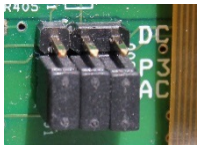
Power supply 120VAC/12 VDC

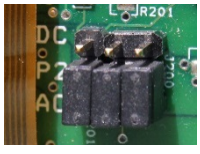
The VOLUCALC™ VS works with the power supply **MLPS2** (120VAC/12VDC 2A). The C size internal rechargeable batteries (on some models) are only used to record power outages. Check the polarity of the wires before connection.

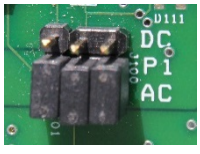
It is essential to connect the sensors and power supply to the correct input locations and set the switches and jumpers to the appropriate positions according to the input value desired.

The "PUMP" inputs can be used to read and record the pump speed or current. Depending on the type of measurement to be read there will be jumpers to put in the right position.

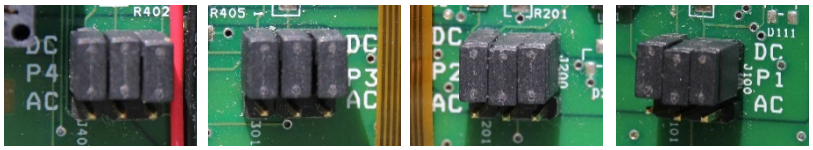








When measuring current, set the jumpers as follows:



Note: Since the circuit is upside down, the order of the pumps are reversed.

When measuring analog values (including Pump Speed) set jumpers to DC.

The instrument's connector has the following inputs and outputs:

Analog output (4-20 mA) proportional to calculated flow rate.

For constant speed pumps, connect a current sensor. This will allow detection of the run cycle of the pumps as well as the current used by the pump (assuming that all phases are roughly similar).

For variable speed pumps, connect the variable speed drive's output (4/20 mA) of each pump to the pump inputs of the VOLUCALC™ VS.

If only 2 variable speed pumps are used, an additional current sensor can be connected for each of the pumps. This will allow the evaluation of the power consumption of each pump.

If 3 variable speed pumps are used, a current sensor can be connected to the stations main power, which would allow the evaluation of power consumption. In this case, the efficiency would be calculated in proportion to the pumped volume.

The level input represents the height of the water in the well of the pumping station. The source can be a pressure sensor, ultrasonic or other.

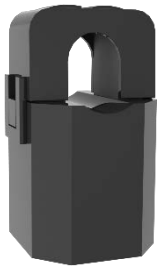
The pressure input is for the pressure in the outlet pipe of the pump. The difference between this pressure and liquid level is used to calculate the head pressure.

Depending on the users requirements, the digital output can be closed when the flow exceeds a limit/set point, activate remote equipment, or create a pulse rate proportional to flow (x volume = 1 pulse).

The digital input is to record changes of state or pulse, such as those from a rain gauge, which is its most common application.

A 12 VDC power supply must come from a stable power supply that can provide 2 amps.

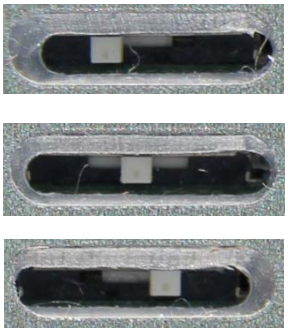
Above the connectors, in the cover of the instrument, there are 4 micro switches accessible through slots placed on the front of the instrument. They allow user to set input capacity for each pump individually. You must also configure the sensor type selected in the Configuration - Input/Output menu of the instrument.



There are two types of current sensors used with the VOLUCALC™ VS. The mini-sensor has a range of 0/15 or 0/75 Amps. The standard clamp-on sensors has a range of 0/150 or 0/300 Amps.

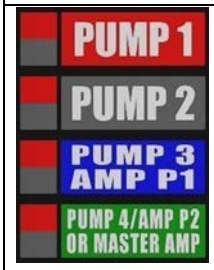
Select the range and type be adjusting the switch position by using a small screw drive or paper clip.

The far left position is for 0/15 Amp mini-sensor, middle is for 0/75 Amp mini-sensor and the right position (ALT) is for 0/150 and 0/300 Amp clamp-on sensors.



Don't forget to configure the sensor type used in the menu of the instrument or by using the MaidDevices Configurator software provided free of charge from MAID Labs web site (www.maidlabs.com).

Pump inputs are configured to read the speed or current of pumps, or the total current drawn by all of the pumps.

Input	Pump 1	Pump 2	Pump 3	Pump 4
 **0.**	Speed P1	Speed P1	Speed P1	Speed P1
	Not used	Speed P2	Speed P2	Speed P2
	Current P1	Current P1	Speed P3	Speed P3
	Not used	Current P2	Current Total	Speed P4

Type of Sensor	Input	Switch Position	Jumper Position	Software Configuration
4-20mA	Pumps and Levels	Right	DC	4-20 mA
0-5V	Pumps and Levels	Right	DC	0-5 V
0-10V	Pumps and Levels	Right	DC	0-10 V
0-24V	Pumps and Levels	Right	DC	0-24 V
15 Amp	Pumps	Left	AC	15 A
75 Amp	Pumps	Center	AC	75 A
150 Amp	Pumps	Right	AC	150 A
300 Amp	Pumps	Right	AC	300 A
Other Current	Pumps	Right	AC	Custom

VOLUCALC™ VS - Installation

1. The Maid Devices Configuration software (on page 34) is used to set up/configure the VOLUCALC™ VS device. To start select “Create a new file”, choose the Volucalc VS and enter its 6 digit serial number.
2. At the window "Inputs and outputs", make sure you configure the device and sensors according to your application.
3. To record overflow events, like SSO’s or CSO’s, use the “level Adjustment” window. Check the “Overflow” option and enter the overflow level desired. If required, configure the method of calculation of your open channel flow device.
4. Complete the Setup and save the configuration file in the root directory of a USB key. Don't forget, the USB stick must operate with a FAT or FAT32 file system. NTFS is not supported.
5. The next step is to connect the device. The next page shows the connection of the level, pressure and rain sensors, and power. The connection to the pumps is explained later.

Digital input

The digital input will read a dry contact output from a wide range of field devices. The instrument generates a low sensing voltage in one of the input connections. When the instrument detects this voltage, the contact is closed. Any sensor generating a pulse, similar to a rain gauge or flow meter can be used with the VOLUCALC™ VS.

The types of sensors can be floats, opening valve detectors, relays or any type of equipment generating a dry contact, when active, provided the frequency pulse rate does not exceed 10 pulses/per second (10 Hz).

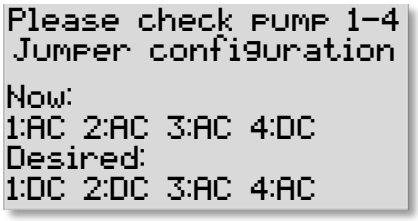
Communication

Devices communicate with a web server via a continuous internet connection. There is no configuration required when connecting to Maid Labs. The devices use port 80 (standard port for all web pages) to communicate with the MaidMaps server. If the computer in the network is capable of browsing the internet, then the communication will work.

Devices are DHCP clients and require no special configuration with the exception of having a DHCP server in the network (present in all standard networks). It is impossible at the moment to enter a fixed IP address to a device. It is possible to connect the unit to a Wi-Fi connection using an external module sold by Maid Labs. Configuration of the module is required using a computer. To know the IP address of the device or its MAC address, please refer to the *IP Information* section, page 25.

Instrument start-up

Once the instrument is powered, it automatically saves the state of its digital and analog inputs.



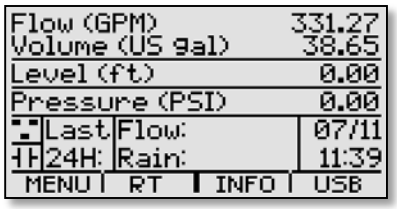
If a message like this one is displayed, then the position of the jumpers (page 9) is not acceptable for the selected configuration. To resolve this, disconnect and open the instrument and move the jumpers according to the displayed message.

The menus

The menu keys on the Volucalc VS device are content related. Do not press more than one key at a time. All key functions are displayed on the current screen.

Main Screen

The main screen of the VOLUCALC™ VS displays data to ensure that the product is working properly and to provide data from the sensors.



`Flow (GPM) 0.00` The displayed flow is calculated by the chosen algorithm. If flow rate for open channel is used (at page 25, 54), then it will control the displayed flow value.

`Volume (US gal) 0.00` The displayed volume is the cumulative volume which is calculated from the displayed flow.

`Level (ft) 0.00` The level is displayed according to the configuration chosen by the user (on page 19 and 42).

`Pressure (PSI) 0.00` The pressure values and span are configured by the user. If there no sensor installed a pressure can be set manually (page 42 and 46).

This symbol indicates that there is no "Ethernet" connection.

This symbol indicates there is an « Ethernet » connection. The Ethernet cable is connected and the IP address is valid (communication is not necessarily functional).

This symbol indicates that the internal relay contacts are open.

This symbol indicates that the internal relay contacts are closed.

`Last Flow:`
`24H: Rain:`

This section of the display provides information on the average flow and the cumulative precipitation for the last 24 hours.

`02/07`
`11:35`

The current date and time is displayed. If an adjustment is required, press the 1 key to access the `MENU` / `Configuration` / `Date & time`, and follow the instructions on page 16.

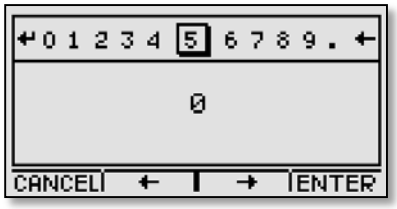
To access the menus from the main screen, the `MENU` 1 button gives access to a scroll, configure and get information about the instrument. To scroll up or dawn use the ▲ 2 and ▼ 3 buttons, then press `ENTER` 4 to execute the function.

The `TR` 2 (Real Time) button is to display data in real time.

The `INFO` 3 button is to display detailed formated recorded data.

The `USB` 4 button is to copy to an inserted USB key different files, including monthly summary reports in CSV compatible format to Excel™.

Numbers selection screen



The setting of the device is done easily using the *MaidDevices Configurator* software (on page 33). However, it is possible to set al functions from the display screen.

A scrolling scale 0 to 9 allows to select a value which is boxed 5. Scroll using the ← 2 and → 3 bottons. To select a number, press `ENTER` 4..

← is to correct or erase a number.

↵ is to accept the number and exit the menu.

When the curser comes on at +, press 4 and change to a negative number.

A negative value may be necessary for some parameters in the overflow equations. It is important to note that in some cases, the entered number will be validated. In such a case, an error message might appear below the window. The user will also be limited as to the number of digits after the decimal.

MENU 1

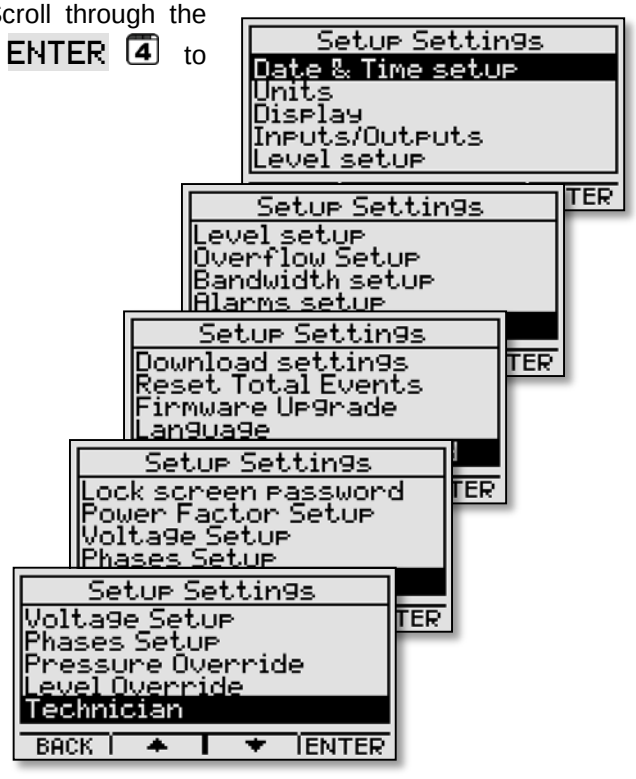
Pressing the MENU 1 button displays 8 options. Browse the menu with the ▲ 2 ▼ 3 keys, and press ENTER to execute.

1. Configure the device
2. Displays data relative to the hardware and software
3. Display IP addresses
4. Test communication
5. Test the relay
6. Test analog output
7. Screen lock
8. Stop the operation of the device.

Instrument setup

Note: **The Volucalc VS was designed to be programmed and setup by MAIDDevices Configurator software** included with the product. This software has many features and libraries which allows the reuse of standard pump curve data for different station files in a Microsoft Windows®™ format. However, minor changes to the Volucalc VS setup can be accomplished through the display screen by following the prompts. If required, (but not recommended) the display screen can be used to program a complete station file.

From the main screen, press the MENU 1 key to access the menu, and then ENTER 4 to open the Setup menu. This enables to configure the following settings. Scroll through the menu with the ▲ 2 and ▼ 3 keys, and then press ENTER 4 to execute.



1. Date & Time
2. Choose measurement units
3. Display
4. Inputs / outputs
5. Level
6. Overflow and flow for open channel
7. Configuring bandwidth
8. Alarms
9. Configuration file
10. Resetting the cumulative
11. Update of the software
12. Language
13. Password to lock the screen
14. Power factor (electrical)
15. Voltage (electrical)
16. Phases (electrical)
17. Pressure fixed (if no pressure sensor)
18. Level fixed (if no level sensor)
19. Technician

After a function is completed, press RETURN 1 to return to the previous menu. The list of submenus is longer than what is displayed on the initial screen.

Date & Time setup

From the main screen, press the MENU 1 key to access the menu, and then ENTER 4 to open the Setup menu, and then ▼ 3 to Date & Time, then press ENTER 4 to execute this function.

This menu displays time, date, and the difference to the Universal Time Coordinated (UTC), also known as Greenwich Mean Time (GMT). With a working Internet connection, the instrument updates automatically its internal clock using internet time. It is possible to force the update via internet with the button SET 3.

When the Bandwidth (page 20) is disabled, time modification is possible with these keys −, + and NEXT. A cursor appears under the first number that can be changed. Keys ▲ 2 and ▼ 3 are to change the value and NEXT 4 is to go to the next variable.

The data is stored in Greenwich Mean Time – GMT and then adjusted to local time for display and when generating files and reports.

This prevents the loss of data caused by changes to daylight savings time to standard time and vice versa.

Changes to the time or date can cause loss of data when entering an older time or date. If this happens, the data following the entered time and date are lost. In this case, a warning message will appear. Changing the GMT does not cause a loss of data.

Units

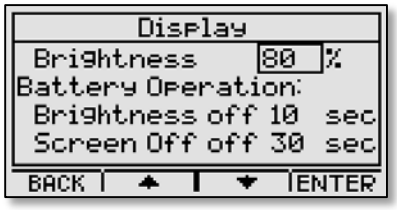
From the main screen, press the MENU 1 key to access the menu, and then ENTER 4 to open the Configuration menu, and then ▼ to Units, then press ENTER 4 to select.

In the VOLUCALC™ VS, units can be chosen based on settings.

- The length can be:
  - Meter (m),
  - Inches (in),
  - Feet (ft) or
  - Centimeter (cm).
- The volume may be in:
  - Liters (l)
  - US Gallons (USG)
  - Cubic Meters (m^3) or
  - Cubic Feet (ft^3)
- Rain maybe in:
  - Millimeters (mm)
  - Inches (in)
- The flow can be:
  - Liters per Second (l/s),
  - US Gallon per Minute (GPM),
  - Million of US Gallons per Day (MGD),
  - Cubic Meter per Day (m^3PD), or
  - Cubic Foot per Second (ft^3PS).

Press the EDIT 4 key to move from one unit to another, and the ▲ 2 keys and ▼ 3 to move from one parameter to another.

Display

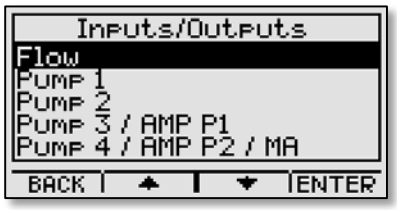


From the main screen, press the MENU 1 key to access the menu, and then ENTER 4 to open the Configuration menu, and then ▼ 3 to Display, and then press ENTER 4 to select.

Press ENTER 4 to select the Brightness setting, then ▲ 2 or ▼ 3 to adjust it between 0% (off) and 100%, in increments of 20%, then ENTER 4 again to accept it.

The backlight (brightness) and display can be disabled by adjusting the on-time in these features. Press ENTER 4 to accept the selection, then ▲ 2 and ▼ 3 to change, then ENTER 4 again to accept the selected time.

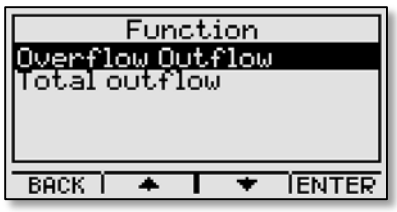
Inputs/Outputs



From the main screen, press the MENU 1 key to access the menu, then ENTER 4 to open the Configuration menu, then ▼ 3 to Inputs/Outputs, then press ENTER 4 to select. VOLUCALC™ VS has several entries of various types that can be configured:

1. Flow rate - analog output proportional to the calculated flow rate
2. Pump 1
3. Pump 2
4. Pump 3 or Current of pump 1 (Pump 3 / AMP P1)
5. Pump 4 or Current of pump 2 or Master Current (Pump 3 / AMP P2 / MA)
6. Level Input
7. Pressure Input

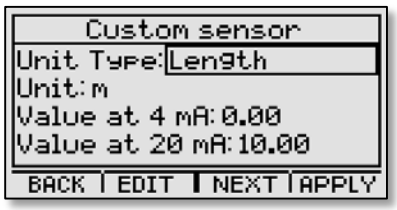
FLOW



When FLOW is selected, the analog 4-20mA output (proportional to the flow rate) has two different types of calculations to choose from in the functions setting. The first is a flow rate from an open channel equation which can also be used in the compilation of overflows. The second will calculate a flow rate derived from the pumps' curves or the pumps' capacities. (see Configurator on page 35)

Select the method of flow calculation, either:

1. Open channel (Overflow), or
2. Total outgoing flow (derived from the pumps' curves or pumps' capacities



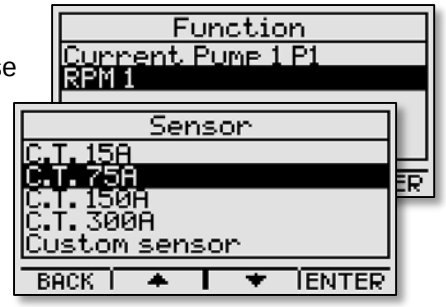
The ENTER 4 button brings up a screen which is com and the output. Custom sensor is used to set characteristics for inputs or outputs.

For the flow, press NEXT 3 to access the engineering units needed, then EDIT 2 if you wish to select a different unit. See the previous page for choices.

Value at 4 mA: is normally zero, which is the minimum flow rate calculable by the instrument.

Value at 20 mA: represents the maximum flow measurement that can be calculated by the instrument. To change this value, follow the instructions on page 14 and enter the numbers in the configuration.

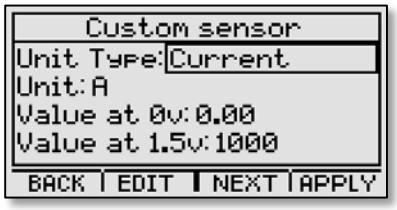
Pump 1 and Pump 2



If pumps are constant or fixed speed, then choose Current Pump 1 P1 or Current Pump 2 P1. Pump 1 P1 means Pump 1 Phase 1. If the pumps are variable speed, then select RPM 1 and RPM 2, then press ENTER 4.

MAID Labs offers a wide range of current clamps, depending on the amperage needed, choose between 15A, 75A, 150A, 300A. However, the Volucalc VS will accept a current sensors not manufactured by Maid Labs. Please read page 11 to make sure to set the jumpers and switches according to your choice.

When the user selects Custom sensor, this feature allows for inputs between 0 and 1.5 volts (common for most current clamps). Per example, if the current sensor has a range of 0 to 400 Amps and its output is 1.5V at 400 amps, then 400 must be entered at Value at 1.5v:. If the output is not 400A at 1.5 Volts, but at 1.33 volts, then the following rule of 3 must be applied: 400 / 1.33 x 1.5 = 451. 451 is the number that should be entered, even if the sensor never reach this value.

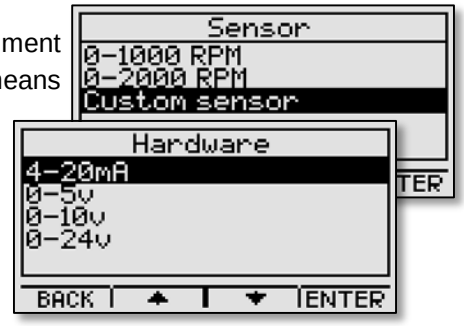


If only one variable speed pump is connected to VOLUCALC ™ VS, then pump 1 input will be used to read speed. As an option, the other 3 pump inputs can be used to read the current for each phase the pump.

If two variable speed pumps are used, the first two inputs are dedicated to read speed while the last two are optionally for reading the phase current from each pump.

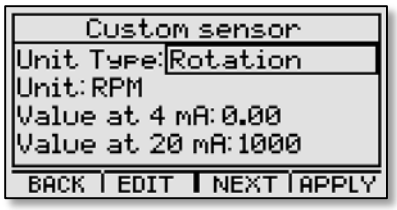
If three variable speed pumps are used, then the last entry can optionally be used to read the current feeding all pumps (Master Current). The purpose of reading the current is to estimate as accurately as possible the energy efficiency of the pumps in volume per kilowatt (l/Kw, Gal/Kw).

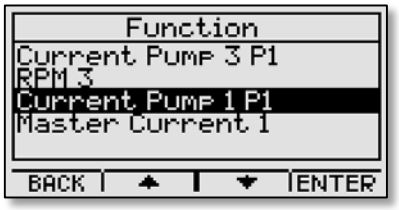
When RPM 1, 2, 3 or 4 is selected, it is highly probable the instrument automatically restarts because selecting RPM instead of Current means jumpers need to change position within the instrument. This is explained sur la page 9. This is another very good reason to use the MaidDevices Configurator (page 33)

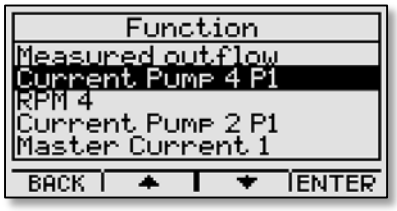


You must then choose the type of output on which VOLUCALC ™ VS is connected. The frequency inverters normally generate 4-20mA or 0-5V, but the VS can also read 0-10V and 0-24V.

Once the type of connection is selected, you must specify the VS values corresponding to the minimum and maximum RPM of the selected pump. For example, if the range is from 0 to 1000 RPM, then indicate 0 at 4 mA or 0 volts, and 1000 at 20mA or 5, 10 or 24 volts.

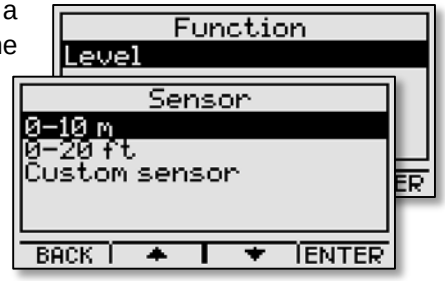






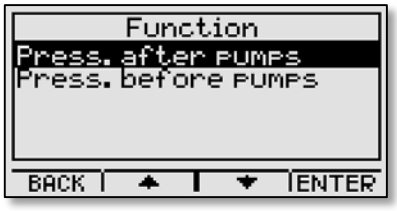
Here are the choices (left) for pumps 3 and 4 inputs.

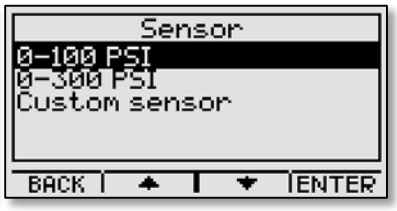
The next item in this menu is **Level Input**. This allows to select a standard sensor range offered by Maid Labs (page 55), or set one as the Maid Labs ultrasonic sensor. The configuration of a **Custom sensor** is as described above for **RPM**. Only the type of unit has changed.



Measured outflow The pump 4 input also allows to read and record flow from an external source, such as a magnetic flow meter, but you must understand the aftereffect (page 37 Flow Algorithm).

The last menu item is the **Pressure Input**. You must decide where to install the pressure sensor, then choose one from the sensors described on page 58, or configure one as described in the previous page.





Level setup

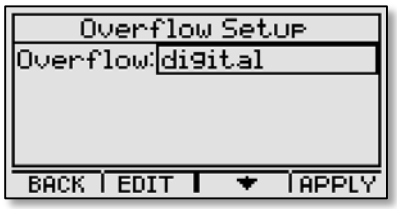
From the main screen, press the **MENU** 1 key to access the menu, then **ENTER** 4 to open the **Configuration** menu, then ▼ 3 to **Level setup**, then press **ENTER** 4 to select.

The **Real Level** is the level measurement of water supplied by the level sensor. The **Computed Level** is the actual or adjusted level for the well. The **Zero level** is the adjustment required to accurately display the computed level. For example, if the "real level" reads 6.5' and the actual level measured is 7.8", the "zero level" requires an input adjustment of 1.3' (0 = 1.3') to display the actual or computed level. The **Zero level** must always be positive number.

It is possible to read the **Real Level** with the **GET** 3 key. To enter a value, use the **EDIT** 2 key, then follow the instructions *Numbers selection screen* on page 14 then press **APPLY** 4 to record the modification.

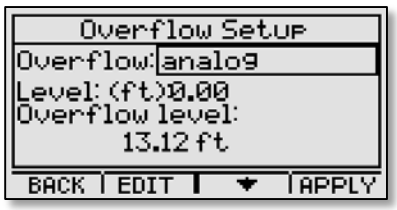
Open Channel Flow (Overflow) Setup

From the main screen, press the **MENU** 1 key to access the menu, then **ENTER** 4 to open the **Configuration** menu, then ▼ 3 to **Overflow Setup**, then press **ENTER** 4 to select.



Two options: **digital** or **analog**.

The digital mode is a dry contact on which a float level is connected to the RAIN input that can also be configured as a digital input and is only used to record the number of times a level is reached and duration of these events.

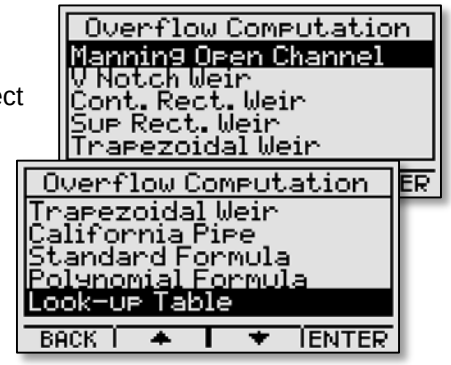


In analog mode, a level sensor is connected to the LEVEL input of the device. It can be configured as an open channel flow meter, while still able to monitor the levels, record the duration and event while in an overflow

condition.

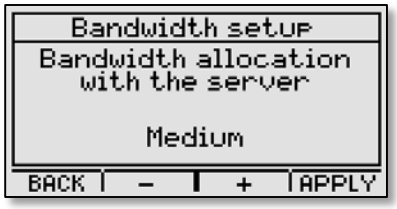
In analog mode, the Level (ft) is measured in real time, and the Overflow level is the level at which the overflow began and open channel flow starts recording. The Overflow level is the only value that the user can define. To do this, press the EDIT 2 key using the *Numbers selection screen* (page 14), then accept the value with the APPLY 4 key. A open channel flow equations window appears.

Open Channel Flow Equations (Overflow)



Depending on the type of weir or primary device used, you can select among the nine equations listed on page 47. (Refer to pages 47-52 of this manual for more details on these equations) Make sure the correct engineering units are displayed in the parameter input screen. When multiple parameters are required, press OK 4 to move on. To select an item in a list, press LIST and to change a value, press EDIT and follow the instructions on page 14. The keys may have different functions depending on the selected equation.

Bandwidth setup

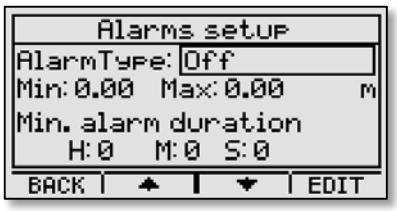


From the main screen, press the MENU 1 key to access the menu, then ENTER 4 to open the Configuration menu, then ▼ 3 to Bandwidth setup, then press ENTER 4 to select.

It is possible to modify the frequency of data transferred to reduce the bandwidth of the device. There are four different transfer rates which can be selected by keys – 2 or + 3 and then the APPLY 4 key to confirm the choice. The Low setting uses the least amount of bandwidth. The device will communicate every 10 minutes and data transferred is compressed. The Medium selection allows the device to communicate with the server every 5 minutes. The High selection communicates as soon as the data is available. It also allows the fastest updates on the MaidMap server. None disables the Ethernet port when communications it is not used.

The instrument automatically adjusts the time when there is a communications link and connected to the Internet.

Alarms setup



From the main screen, press the MENU 1 key to access the menu, then ENTER 4 to open the Configuration menu, then ▼ 3 to Alarms setup, then press ENTER 4 to select.

DIGITAL OUT The relay contact closes when the alarm is activated and opens when the alarm ends. Press the EDIT 4 key to select the type of alarm to configure. There are 5 options for the Alarm type field: Off, Min, Max, Min/Max and Remote. The displayed units will be in m, cm, in or ft.

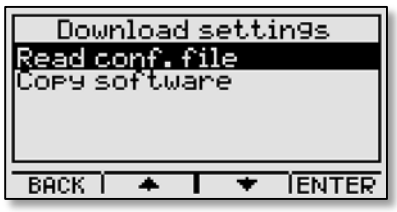
When Off is selected, no alarm will be generated. Min an alarm is generated under the minimum value. An alarm is generated above the maximum value when Max is selected. The Min/Max selection indicates that the Min and Max values have been reached and the alarm active. Note: the values of Min, Max are always displayed, but are only valid if the alarm is activated. The fifth option is Remote and allows the MaidMaps software to manage the alarms through an Ethernet communication. However, the bandwidth selections will

affect the speed at which the alarm will be received by the device. Select the High Bandwidth setting for the quickest response time.

To accept the chosen alarm type and to move from one field to the next, press ▼ 3. To enter or edit a value, press EDIT 4 and the *Numbers selection screen* (page 14) will appear.

Download settings

From the main screen, press the MENU 1 key to access the menu, then ENTER 4 to open the Download settings menu, then ▼ 3 to Download Settings, then press ENTER 4 to select.



To read the file created by **MaidDevices Configurator**, select Read conf. file, then ENTER 4. Follow the instructions on the screen.

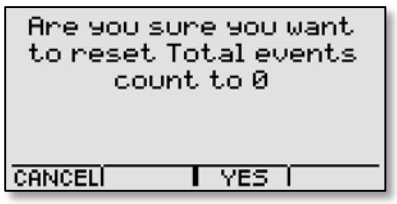
The settings can also be configured from the **MaidDevices Configurator** software. This software can be copied to a USB key from the instrument. Simply select from the configuration menu, Download Settings, then Copy software, then ENTER 4. A USB key will be required in the instrument.

The **Config.zip** compressed file will be copied to the root directory of the USB key. Double-clicking on the file name should unpack it. Click on **Config.exe** to run the application.

Reset total events

From the main screen, press the MENU 1 key to access the menu, then ENTER 4 to open the Configuration menu, then ▼ 3 to Reset total events, then press ENTER 4 to select.

This function resets the total events contained in the main screen. After selecting this function, press YES 3 to confirm the deletion of the data from the main screen or CANCEL 1 to return to the previous screen.



To reset to zero all the total events of the instrument, go to the Factory Reset function on page 24.

Firmware Upgrade

From the main screen, press the MENU 1 key to access the menu, then ENTER 4 to open the Configuration menu, then ▼ 3 to Software upgrade, then press ENTER 4 to select.

MAID Labs will continue to update and improve our products/software of its instruments. The latest version of the internal software can be obtained from the website www.maidlabs.com for devices having been registered.

Insure the reliability of the energy source before beginning the programming of the instrument. There must not be any power loss during the update. To reduce this risk, insure that the rechargeable batteries have a minimum capacity of 60%. This can be checked on the main display by disconnecting the instrument from its external source. **Never put alkaline batteries in an instrument made for use with rechargeable batteries. They may create damage to the instrument and to people.**

After selecting Firmware update, insert a USB key that contains the **volucalcvs.hex** file in the root directory. Once this file is detected, the update programming will automatically start and a percentage of the update progress will be displayed in steps. The instrument restarts when the update is completed.

Language

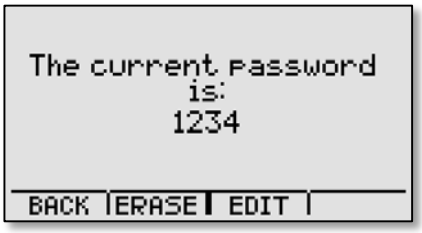
From the main screen, press the MENU 1 key to access the menu, then ENTER 4 to open the Configuration menu, then ▼ 3 to Language, then press ENTER 4 to select.

The instrument can work in French or in English. Press ▼ 2 or ▲ 3 to select the language, then APPLY 4 to accept the displayed language.

Lock screen password

From the main screen, press the MENU 1 key to access the menu, then ENTER 4 to open the Configuration menu, then ▼ 3 to Lock Screen Password, then press ENTER 4 to select.

By default and if no lock has been configured, simply press 1234 to have full access to the menus of the device. To create a custom locking key, press EDIT 3 and enter a 5-digit code between 1 and 4, using the keys 1, 2, 3 and 4..

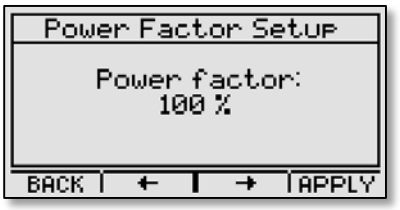


Power Factor Setup

From the main screen, press the MENU 1 key to access the menu, then ENTER 4 to open the Configuration menu, then ▼ 3 to Power Factor Setup, then press ENTER 4 to select.

The power factor is normally found on the utilities electricity bill. It affect the number of kilowatts consumed.

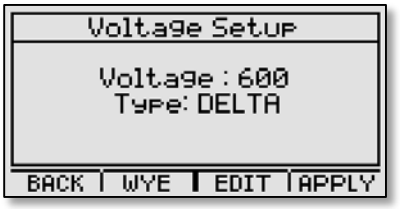
The ← 2 and → 3 keys increase or decrease the percentage displayed.



Voltage Setup

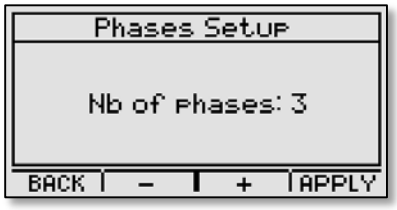
From the main screen, press the MENU 1 key to access the menu, then ENTER 4 to open the Configuration menu, then ▼ 3 to Voltage Setup, then press ENTER 4 to select.

The average voltage of the pumps is normally calculated from phase to phase, ie measured in delta. If the voltage was measured between a phase and ground, then press the WYE 2 key to change the reading mode.



To enter a value, press the EDIT 3 key, then follow the instruction from page 14, then press APPLY 4.

Phases Setup

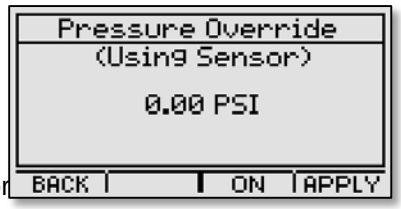


From the main screen, press the MENU 1 key to access the menu, then ENTER 4 to open the Configuration menu, then ▼ 3 to Phase Setup, then press ENTER 4 to select.

Many of the pumps used in sanitation and water supply applications have three phases. If this is the case, let the number of phases be 3. If only one current sensor is connected for the pump, then the current multiplier of "3" is used to estimating the total power usage of the pump. If the pump has two phases (240 volts), then choose 2 and 1 phase for 120 volts.

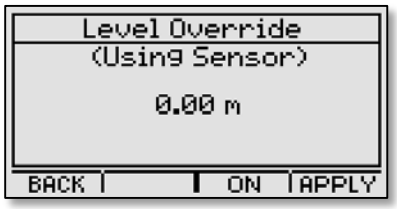
The keys – 2 and + 3 increase or reduce the number of phase. To accept the selection, press APPLY 4.

Pressure Override and Level Override



From the main screen, press the MENU 1 key to access the menu, then ENTER 4 to open the Configuration menu, then ▼ 3 to Pressure Override or Level Override, then press ENTER 4 to select.

The override selection for pressure and level allows the user to input a value for damaged for missing sensors. Please note, these values will not change and will affect the accuracy of the data.



Press the ON 3 key to indicate that a pressure or level will be entered, then EDIT 2, follow the instructions at page 14, then press APPLY 4 to accept the value. To deactivate the fixed pressure or level, press OFF 3.

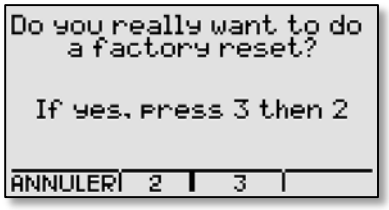
Technician

From the main screen, press the MENU 1 key to access the menu, then ENTER 4 to open the Configuration menu, then ▼ 3 to Technician, then press ENTER 4 to select.

The technician menu allows access to functions that are normally reserved for factory or experienced technicians. In this menu, please note there are functions that could totally erase the memory of the instrument. These are the functions of Technicien :

1. Factory Reset
2. Erase Files
3. SD Card Info
4. Copy Manual from USB
5. Copy App from USB
6. ScreenShot
7. Inputs Calibration
8. Raw Values

Factory Reset



This resets the device to the same condition that it was when new and never installed. To start press (in the order) 3 and 2. Nothing will be in the internal memory after this execution. It is equivalent to formatting the disk of a computer.

Delete File

This function allows the user a selection of files to be deleted from the memory.

`Assert` is a bug tracking file. The `Digital` file, and `TempBatt` are explained in the *Raw data* section below on this page. `Level` is the level readings file, `Http` file is bug tracking file for communication and `Ethernet buffer` file is temporary registration file of the data to send to MaidMaps when the communication is not possible. `Alarm` is the file of the alarms and the `Overflow` is the overflow file.

To delete a selected file choose and press `ENTER` 4 to access the next screen, then `OK` 2 to confirm.

SD Card Info

This function allows you to check the amount of memory for internal memory and free space.

With 2 GB of memory, there is enough memory for the lifetime of the instrument, or more than 10 years.

Copy Manual from USB

This function allows more recent version of the user manual copied to the instrument.

Copy App from USB

This function is to copy a different application in the instrument. This can be used to change the use of the instrument or to test it.

ScreenShot

This function takes a picture of what is on the screen and copies them to a USB key in BMP format. All screens in this manual have been created with this function.

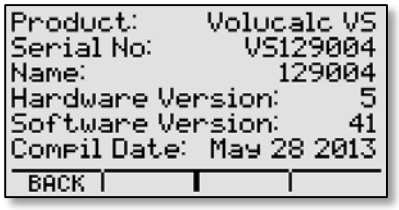
Inputs Calibration

This function reads the inputs' status.

Raw Values

This function will read inputs in real time before they are recalculated.

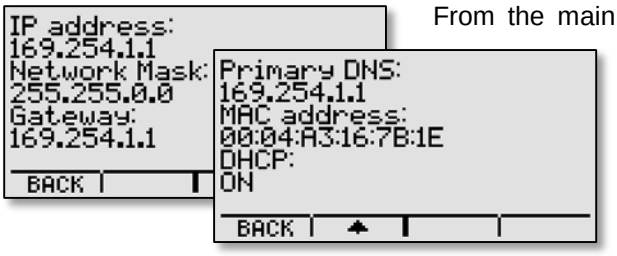
Device info



From the main screen, press the MENU 1 key, then ▼ 3 one time and ENTER 4 to display Device Info.

Displays the serial number of the instrument. The serial number is required for DevicesMAID Configurator.

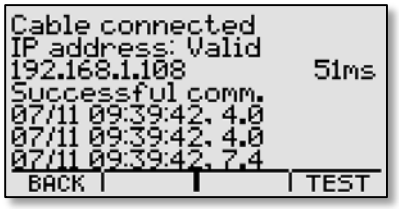
IP Informations



From the main screen, press the MENU 1 key, then ▼ 3 twice and ENTER 4 to display IP Informations.

This screen provides the communications and network information including IP, MAC address, network Mask and Gateway data.

Communication test



From the main screen, press the MENU 1 key, then ▼ 3 3 times and ENTER 4 to start a Communication test.

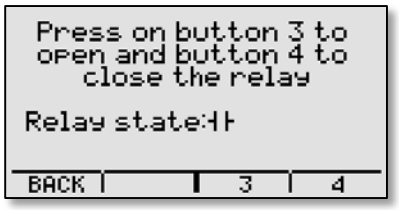
The TEST 4 key allows you to manually observe the commands that are sent.

The information appearing under the 'Successful Communication' status are date and time of the last communication, the command sent (represented by a digit) and the replies received. This information is not important to the user but allows a technician additional information to diagnose a problem.

Successful comm.
07/11 09:39:42, 4.0

Cable disconnected
IP address: Invalid

Relay test



From the main screen, press the MENU 1 key, then ▼ 3 4 times and ENTER 4 to do a Relay test.

The user can change the status of the internal relay contacts of the instrument.

⊣⊢ This symbol indicates that the internal relay contacts are open.

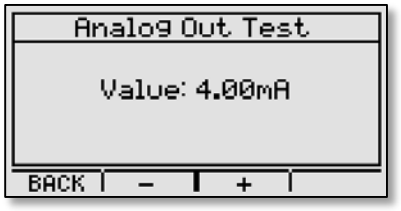
⊣⊢ This symbol indicates that the internal relay contacts are closed.

Press 3 to open the relay and 4 to close it. You should be able to hear it change positions.

Analog output test

From the main screen, press the MENU 1 key, then ▼ 3 5 times and ENTER 4 to Analog Out Test.

The user can change the value of the 4 to 20 mA analog output in 1 mA increments by pressing the buttons – 2 to decrease the value and + 3 to increase it.



Lock screen

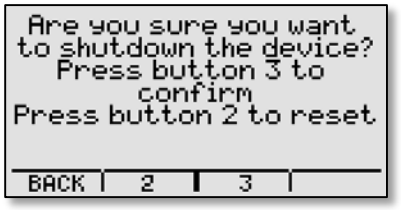
From the main screen, press the MENU 1 key, then ▼ 3 6 times and ENTER 4 to execute Lock Screen.

Lock screen allows restricting access to the device in the main menu. By default, if no lock key has been configured, simply press 1, 2, 3, 4 to have full access to the menus of the unit. If the lock key has been configured (*lock screen password*, page 22), just grab it with the buttons. The device automatically locks the screen after 30 seconds.

Shutdown device

From the main screen, press the MENU 1 key, then ▼ 3 7 times and ENTER 4 to Shutdown device.

This procedure is recommended when there is maintenance to do on the device, for example, a battery change. This avoids the possibility of losing recent data that has not been stored. This function stops all operations of the device. To restart normal operations, simply remove the power including the batteries and reconnect after a few seconds.



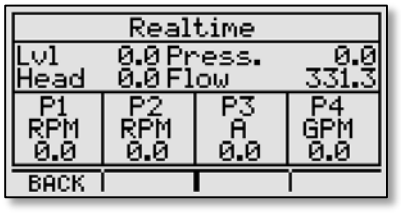
RT 2 (Real Time)

From the main screen, press the RT 2 key to display the Real Time screen.

The RT menu displays information in real time.

Real time

From the main screen, press the RT 2 key, then ENTER 4 to display the Realtime screen.



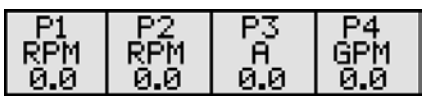
Lvl 0.0 level represents the current data from the probe.

Head 0.0 is the current head pressure, a difference between the inlet or level pressure and the pumped outlet pressure.

Press. 0.0 represents the pressure at the pump outlet.

Flow 0.0 represents the flow rate calculated using the derived flow algorithm.

P1 to P4 represents the pump inputs.



RPM indicates a rotation speed in Revolution Per Minute.

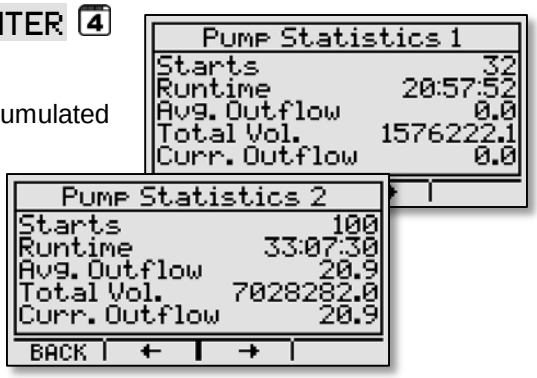
A indicates a current in Amp.

GPM, l/s or other flow unit will be displayed if an external flow meter is connected to the VOLUCALC™ VS and the VS is recording the displayed flow.

If nothing is connected, then N/A (non available) will be displayed.

Pump Statistics

From the main screen, press the RT 2 key, then ▼ 3 and ENTER 4 to display Pump Statistics of the first pump.



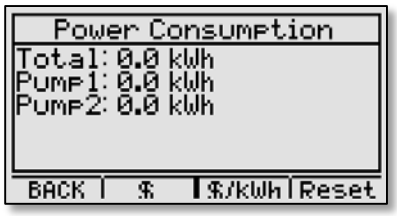
This screen provides statistics for each pump (not pump inlet) accumulated since the last time the cumulative statistics were cleared (see page 15) or a "Factory Reset" (page 23) was executed. Information includes:

1. Starts - Number of starts
2. Run time
3. Avg. Outflow - Average flow out of the pumps
4. Total vol. - Total pumped volume
5. Curr. Outflow - Current Outflow

The keys ← 2 and → 3 are used to scroll from one pump to another.

Power Consumption

From the main screen, press the RT 2 key, then ▼ 3 twice and ENTER 4 to display Power Consumption.



This screen displays the overall power consumption and kilowatt hour per pump. To achieve this, VOLUCALC ™ VS multiplied the current read of the sensor (page 15) by the number of phase by the voltage (page 15) and the factor power (page 15).

BACK 1 is to get to the previous menu

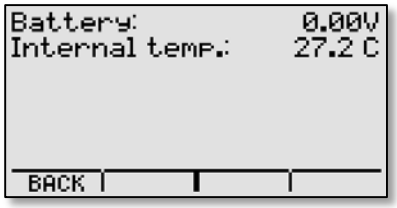
$ 2 will switch between kWh and $. $ is the cost of operating the station and the pumps.

$/kWh 3 will change the cost per kWh

Reset 4 will reset the kWh values to zero (0).

Internal Info

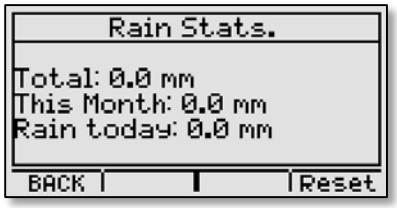
From the main screen, press the RT 2 key, then ▼ 3 3 times and ENTER 4 to display Internal Info.



If batteries are installed in the instrument (depending on the model version), this screen allows you to see the voltage capacity.

The temperature displayed is accurate to ± 3 °.

Rain Statistics



From the main screen, press the RT 2 key, then ▼ 3 4 times and ENTER 4 to display the Rain Stats.

INFO 3

From the main screen, press the INFO 3 key.

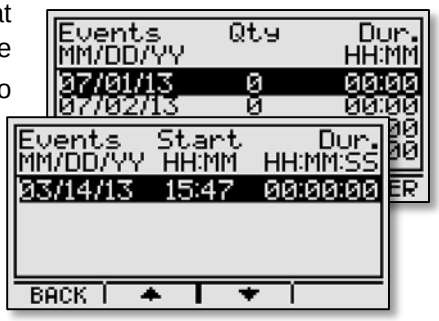
Three reports are available:

- Events Reports displays events relative to the digital input,
- Alarms Report displays overflow, S.S.O. and other alarms recorded by data from the level sensor.

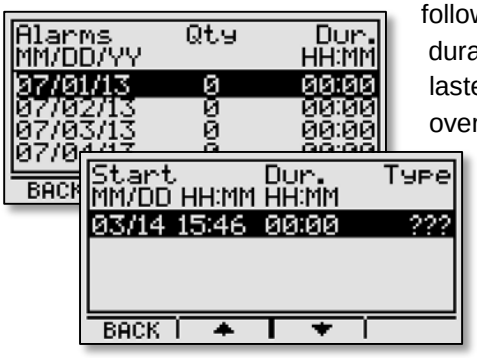
Press ENTRER 4 to execute.

The current month is automatically preselected. Press MONTH 2 or YEAR 3 to select the month or year to change, and then 2 and 3 to scroll among the months and years for which data was recorded, and press ENTER 4.

Once the month has been selected, recorded daily information for that month can be viewed. To view daily details select the day to view the recorded events using ▲ 2 and ▼ 3, and then press ENTER 4 to display it.

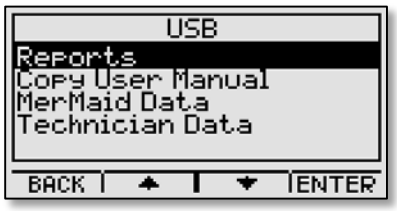


The daily detailed report displays the date in the format MM/DD and time in the format HH:MM. On each line, there is the start time of the event, followed by its duration. Note that a duration of 00:00 means that it lasted less than 60 seconds. In the overflow report, the Flow will also be displayed. When pressing the NEXT 4 button, the last column displays the Volume.



If a day is not selected, the first event of the month will be displayed, then the next etc… In any case, press ▲ 2 and ▼ 3 to scroll through all events within the selected month.

USB 4



From the main screen, press the USB 4 key. This menu is to:

1. Copy reports on the USB key
2. Copy this instrument manual to USB key
3. Copy MerMaid format data the USB key
4. Copy to the USB key data that would allow the technician to help out, if necessary.

Press ▲ 2 and ▼ 3 to select the function to execute, then ENTER 4..

Use a USB drive formatted with FAT16 or FAT32. The amount of files on the key influence the time to copy files. It is best to reserve the use of a USB key downloads from MAID Labs' instruments.

Insert a USB key when the message asks for it.

When the transfer is completed, a message indicates that you can remove the key.

Reports

While viewing main screen, press the USB 4 key, then ENTRER 4 to access the Reports menu. The 3 choices are:

1. Monthly Events, (per the next page) without the volumes and average flow.
2. Monthly Overflow, which has flow and volume data
3. Monthly Volucalc VS, which summarize the monthly operation of the station.

The monthly reports are in CSV format. If Excel™ is installed on the computer, monthly reports will load automatically. The file name is composed of an identifier (name or serial number) plus the year and the month for which it is created. Note: If the device language is different from your computer, the data might not be presented properly in Excel. To remedy this, simply select the appropriate separator when importing into the spreadsheet (Excel).

A file is created for each month of operation of the instrument, unless all the data has been deleted intentionally using the Technician menu on page 27

Examples of reports are on the two next pages, the text format was altered to make them easier to read.

The reports are copied on the USB key in the subdirectory Monthly Reports, which is under the directory with the name given to the instrument or having its serial number in the root directory. See Device Name on page 37.

Site: LS 24	12-2012	Overflow	Volume	Avg Flow
Date	Duration	Qty	Gallons	GPM
1	N/A	N/A	N/A	N/A
2	N/A	N/A	N/A	N/A
3	N/A	N/A	N/A	N/A
4	N/A	N/A	N/A	N/A
5	N/A	N/A	N/A	N/A
6	N/A	N/A	N/A	N/A
7	0:00	1	2	8.00
8	3:54	3	46,812	3.33
9	2:21	2	80,770	11.17
10	0:00	2	1	0.07
11	1:14	1	29,027	391.46
12	0:00	1	4	126.00
13	0:00	1	2	8.40
14	0:00	2	2	0.15
15	0:00	1	5	10.34
16	4:10	1	46,871	186.92

The Monthly Events report summarize the monthly information regarding events recorded through the instrument's digital input, or which occurred because a set point was reached. This report looks like this one, without the two right columns.

The Monthly Overflow report summarize the monthly information regarding events recorded through the instrument's digital input, or related to a reached set point. When the set point is reached, Volucalc VS uses the selected open channel equation to evaluate the quantity of water lost during the events and the average flow of these events.

If the set point is placed very low, then this report can be used as a monthly report showing the total quantity of water going through the station.

If the VOLUCALC ™ VS was not installed on the first day of the month N/A (Not Available) appears on the lines on these dates without data.

Following the daily data begins the details of each event.

Date	From	To	Duration	Volume	Avg Flow
7	07:45:03	07:45:18	00:00:15	2.0	8.00
8	10:21:23	12:22:22	02:00:59	2,548.0	21.06
8	13:03:25	14:23:25	01:20:00	32,811.0	410.14
8	15:02:01	15:35:13	00:33:12	11,453.0	344.97
9	14:31:14	16:31:35	02:00:21	80,749.0	670.95
9	15:00:23	15:00:36	00:00:13	21.0	420.00
10	09:12:11	09:12:16	00:00:05	0.1	1.44
10	09:41:04	09:41:14	00:00:10	1.0	6.00
11	10:01:16	11:15:25	01:14:09	29,027.0	391.46
12	10:25:49	10:26:51	00:01:02	4.2	126.00
13	10:15:00	10:15:15	00:00:15	2.1	8.40
14	09:31:59	09:32:05	00:00:06	0.9	9.00
14	09:32:10	09:32:15	00:00:05	0.8	9.60
15	14:21:15	14:21:44	00:00:29	5.0	10.34
16	02:55:01	07:05:46	04:10:45	46,871.0	186.92

The Monthly Volucalc VS report summarize the station's data. It provides the date of the report, the station and the month of the recorded data. The Average Outflow is the average flow rate based on the pump curves, the pump capacities, or the external flow meter connected to an analog input. Same with the volumes. For the open channel equation, use the Monthly Overflow report of the previous page. For variable speed pumps, the runtime is usually high and the number of starts low. Constant speed pumps are opposite.

Report generated on 07/29/2013 at 00:01				www.maidlabs.com						
Device name:	129003			Serial number:		VS129003				
Report:	Pump summary			Month:	July	2013				
Voltage (V):	600			Power factor (%):		100				
Unit:	l/s	US gal	l/s	hh:mm:ss	l/s	hh:mm:ss			hh:mm:ss	hh:mm:ss
Date	Average Outflow	Total Outflow Volume	Min. Flow	Min. Time	Max. Flow	Max. Time	Starts P1	Starts P2	Runtime P1	Runtime P2
1	80.12	1828624	0.00	17:23:32	208.72	15:02:08	0	1	0:00:00	23:55:07
2	74.53	1701051	2.05	5:31:50	161.87	14:59:13	0	0	0:00:00	23:59:59
3	72.58	1656513	0.00	5:00:10	180.68	14:24:24	0	0	0:00:00	23:59:59
4	157.62	3597506	0.00	12:18:09	407.22	9:28:33	0	1	0:00:00	23:59:54
5	95.49	2179421	0.00	22:16:09	287.33	13:37:35	0	1	0:00:00	23:59:52
6	83.76	1911714	26.84	5:33:37	219.23	14:11:49	0	0	0:00:00	23:59:59
7	283.72	6475777	0.00	6:31:25	833.82	5:52:52	3	2	18:13:58	4:47:24
8	335.91	7666843	293.62	3:56:11	382.32	10:03:06	0	0	23:59:59	0:00:00
9	334.13	7626180	295.28	5:08:11	534.96	15:46:20	0	0	23:59:59	0:00:00
10	340.99	7782825	293.54	4:49:49	436.41	19:07:08	0	0	23:59:59	0:00:00
11	341.56	7795945	302.65	3:43:59	523.04	17:25:01	0	0	23:59:59	0:00:00
12	334.26	7629226	90.54	13:00:43	477.62	13:05:33	0	1	23:59:59	0:00:30
13	330.60	7545752	293.54	5:05:44	487.34	13:41:11	0	0	23:59:59	0:00:00
14	325.49	7429081	290.61	7:21:17	463.67	13:42:04	0	0	23:59:59	0:00:00
15	324.12	7397846	288.93	6:01:33	434.65	14:36:11	0	0	23:59:59	0:00:00
16	323.02	7372637	288.09	4:19:45	415.51	14:30:32	0	0	23:59:59	0:00:00
17	322.38	7358034	288.06	6:36:45	478.06	14:29:27	0	0	23:59:59	0:00:00
18	314.74	7183602	285.02	4:02:02	447.00	13:30:48	0	0	23:59:59	0:00:00
19	354.31	8086734	0.00	21:38:38	785.92	21:36:52	5	2	23:59:32	2:25:11
20	524.08	11961761	359.88	6:41:29	666.09	5:01:17	0	0	23:59:59	10:50:38
21	377.07	8606329	327.17	23:56:05	585.78	11:06:41	0	0	23:59:59	0:00:00
22	355.88	8122733	0.00	14:45:03	545.14	13:24:26	2	0	23:59:49	0:00:00
23	350.08	7990347	305.66	4:41:27	552.06	10:40:27	0	0	23:59:59	0:00:00
24	341.50	7794376	0.00	6:44:27	525.79	9:40:35	1	0	23:59:55	0:00:00
25	337.47	7702383	296.86	6:03:45	540.48	18:29:36	0	0	23:59:59	0:00:00
26	334.10	7625537	294.03	5:07:24	454.17	13:48:17	0	0	23:59:59	0:00:00
27	333.63	7614950	291.45	3:04:19	544.84	15:05:49	0	0	23:59:59	0:00:00
28	328.65	7501278	289.35	5:31:19	550.89	15:29:13	0	0	23:59:59	0:00:00
29	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D
30	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D
31	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D
Total:	289.71	185144992	0	7/24/2013 6:44:27 AM	833.82	7/7/2013 5:52:52 AM	11	8	522:13:14	161:58:36

Copy User Manual

From the main screen, press the USB 4 key, then ▼ 3 and then ENTRER 4 to access Copy User Manual. This function copies the PDF version of this user manual from the internal memory of the instrument to a USB key.

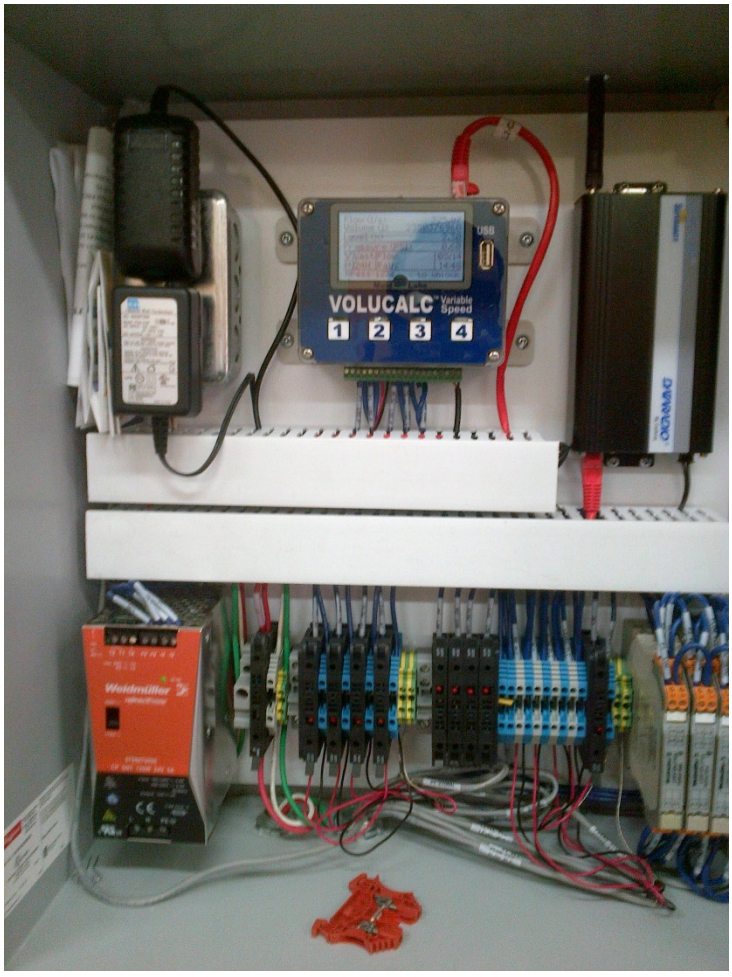
MerMaid Data

From the main screen, press the USB 4 key, then ▼ 3 twice and then ENTRER 4 for MerMaid Data. The data is copied into a file that is formatted for the MerMaid software. To learn more about the MerMaid format, visit www.maidlabs.com/software-mermaid/.

Technician Data

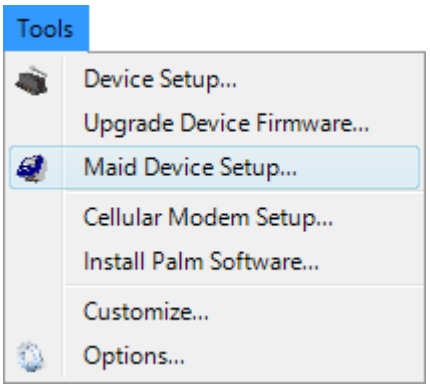
From the main screen, press the USB 4 key, then ▼ 3 3 times and then ENTRER 4 to select MerMaid Data. The files generated by this function may help a technician with diagnostic.

Volucalc VS communicating through a cellular modem,



MaidDevices Configurator

The MaidDevice Configurator software comes with the product and is installed within the MerMaid analysis software. Within the MerMaid software the MaidDevices Configurator is located in the Tools tab section. It will also be called **Configurator** in the text.

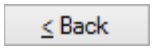


Read the USB section on page 25 for copying the software configuration to a USB key.

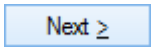
MaidDevices Configurator is used to setup the following instruments:

- **EE-400** Event encoder
- **FlowMaid** level monitor and open chanel flowmeter
- **PressureMaid** tap water pressure monitor
- **VOLUCALC™ VS** Fixed and Variable Speed pump flowmeter and open channel flowmeter

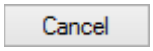
The configuration software has three basic tabs at the bottem of each window:



Returns to the previous window without saving the values.



Continues to the next configuration window and saves your values.



Closes the MaidDevices Configurator software.

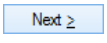
Welcome Window

The Configurator welcome window has three selections:

`Create a new file`

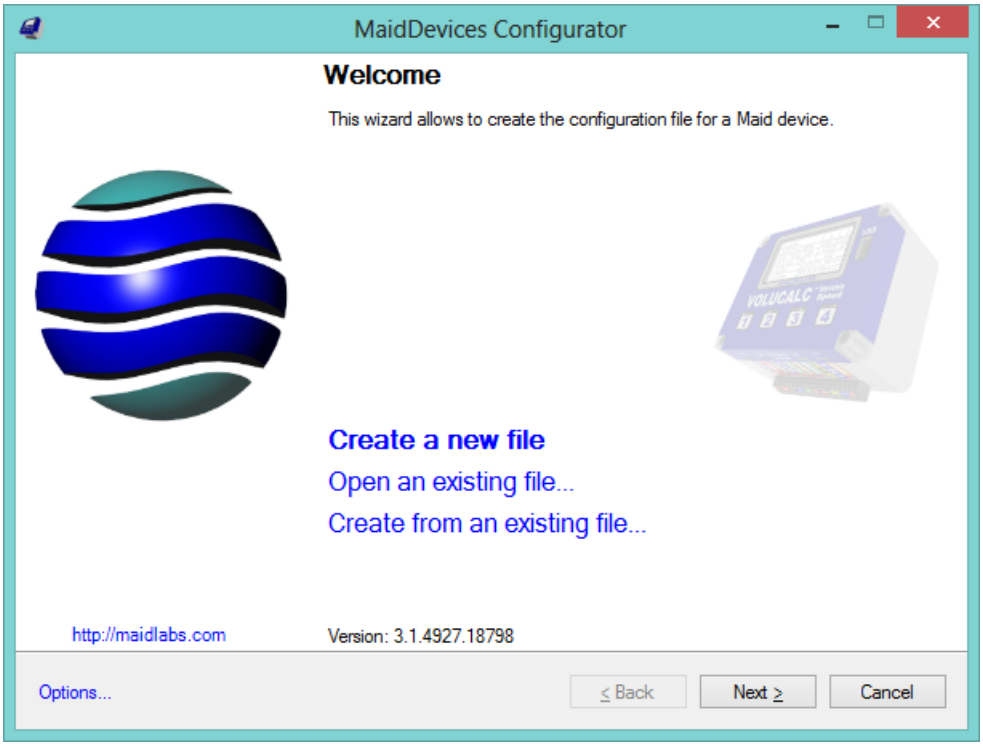
`Open an existing file -` for editing, modifing or viewing setup data

`Create from an existing file -` allows the user to enter parameters for a device already created.

By default, the configuration process starts by creating a new file when 

is pressed.

The **`Options`** link on the bottom left corner of the window is for setting up your preferred engineering units (ft, meters etc…).



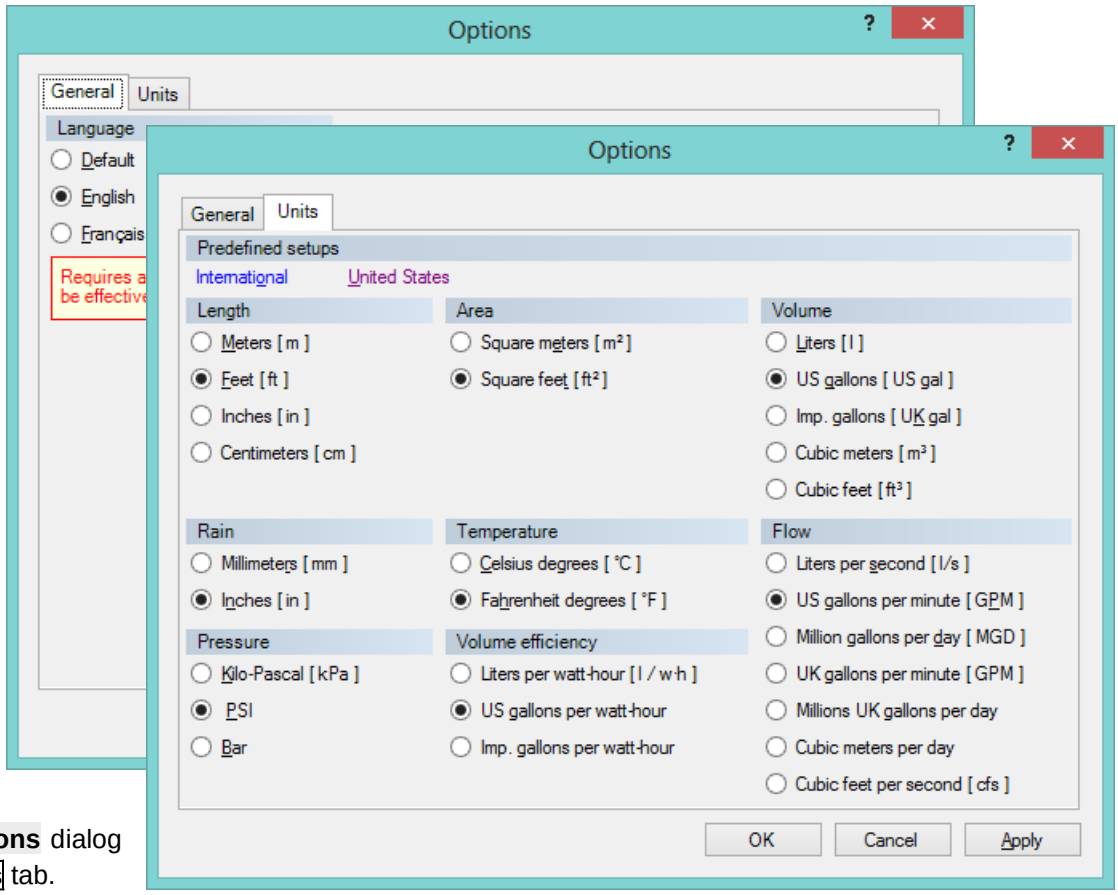
Options

Two menu tabs are available: General and Units.

The General tab selects the desired language. By **Default**, the Configurator will appear in the language of your computer. It is possible to change it at anytime. The application must be restarted when its language is changed.

Press the Apply tab to save these changes.

By default, the **Options** dialog will open on the Units tab.

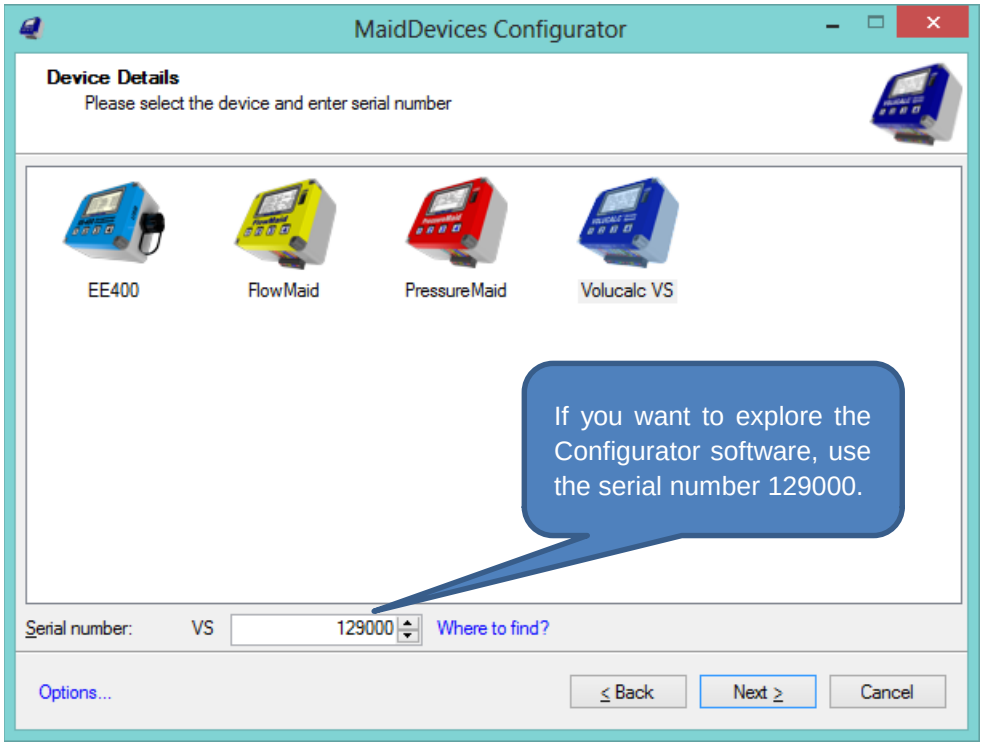


If you select **United States**, the standard engineering for this region will be selected. It is possible to change them to fit your needs. **International** units will be metric. Press the Apply tab to save the changes.

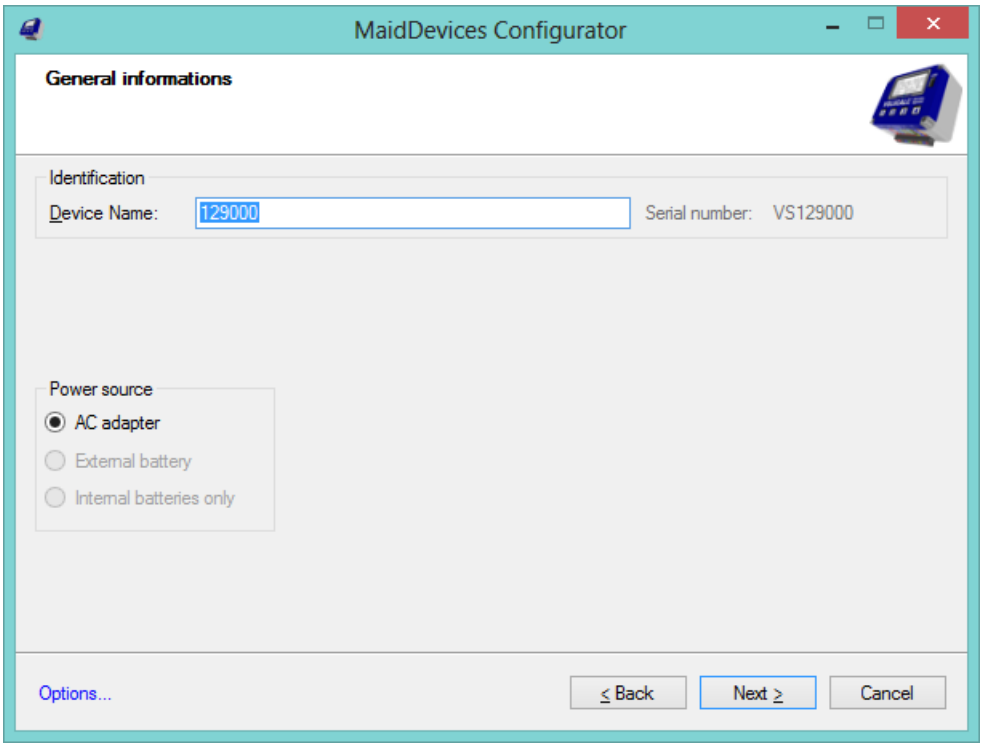
Device Details

Select Volucalc VS, then enter the serial number of the device. This number is on the label underneath the device and also appears on the *Device Info* screen (p. 25). If the serial number is incorrect, the instrument will not be able to read the configuration associated to it.

MaidDevices Configurator file is located in the root directory of the USB drive called VSxxxx (VS with serial No.).



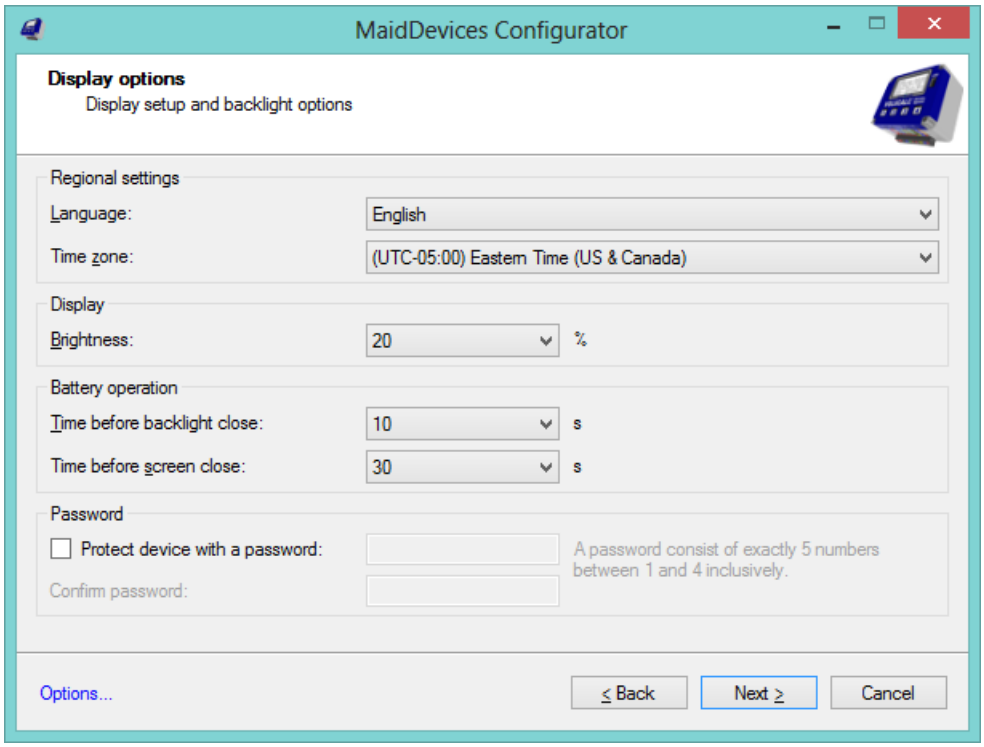
General informations



The instrument's files are identified by names. The **Device Name** is used to identify the data files copied from the instrument to the USB key. The name will be useful when a USB key is used for multiple devices. If no name is given, then the serial number of the instrument becomes its name. A maximum of only 20 characters in the name can be displayed on the screen of the instrument.

The **Power source** section defaults to AC adapter since this is the only way the VOLUCALC ™ VS can be powered. The VS does not work on batteries. Click Next ≥ to continue.

Display options



In the **Regional Settings** French and English are the **Language** selections for the display and reports. The **Time Zone** is automatically adjusted to the computer's time and may be changed if required. The instrument works internally in Universal Time Coordinated (UTC), also known as Greenwich Mean Time (GMT) and will compensate for daylight savings automatically. When connected to the Internet the instrument will update the internal clock.

The **Display Brightness** can be adjusted between 0% and 100% in increments of 20%. The default value is 20%.

Battery Operation is related to other MAID Labs' products which also use the Configurator software.

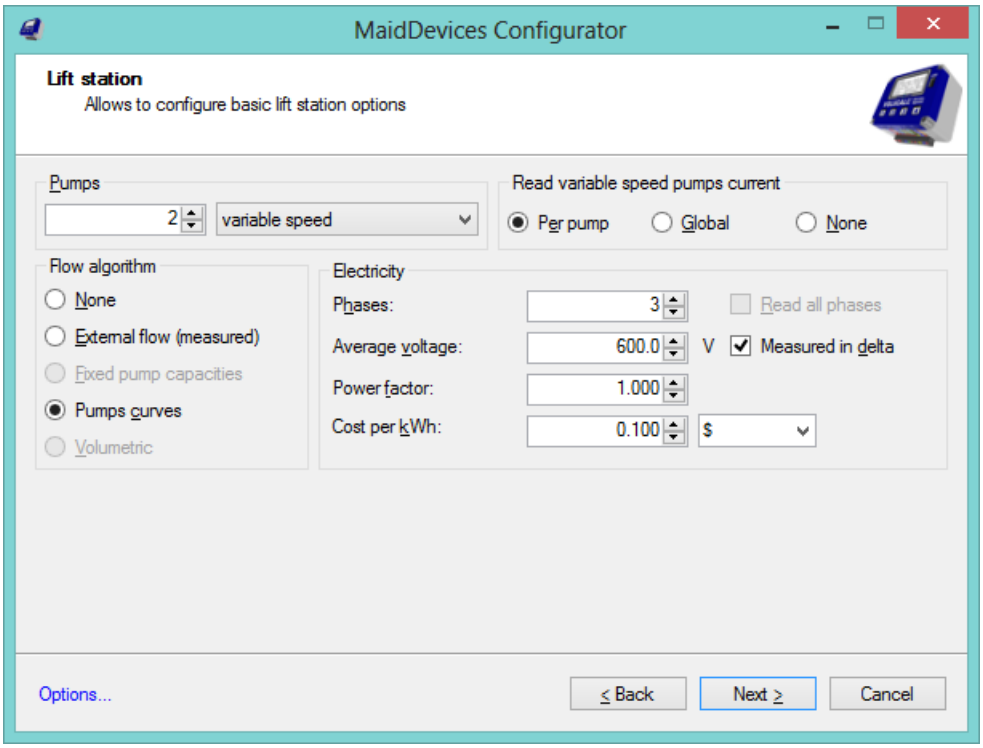
An optional **Password** is use for locking the display screen. Make a 5 numbers code with digits between 1 and 4 representing the 1, 2, 3 and 4 buttons of the instrument. Click Next ≥ to continue.

Lift station

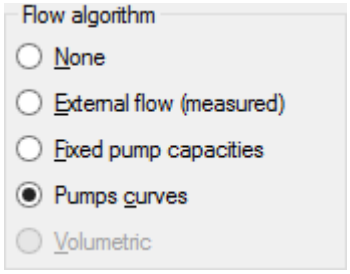
This window will effect many of the following dialog windows. First select the number of pumps by clicking ▲▼.

The drop down selection variable speed provides choices depending on the type of pumps. The selections are variable speed, fixed speed or any mixture of the two … if more than one pump.

If more than one pump and that there is at least one variable speed, then you must enter the pump curves for all pumps, even the fixed speed pumps.



If all pumps are fixed speed, provide the capacity of each pump and pump combinations.



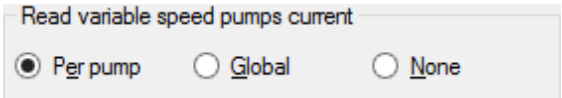
Flow algorithm selects how the flow is calculated. If the VS is not used for flow calculation, select **None**.

External flow (measured) is from an external source, such as a magnetic flow meter. The flow rate will be displayed and used for energy efficiency calculations.

Fixed pump capacities will allow a user to enter pump capacities if all pumps are constant speed pumps. A dialog window to enter these values will be displayed at the appropriate time.

Pump curves are available for all types of pumps. The advantage of the pump curve over the fixed capacity is that if the level is very high for long periods, it will calculate a derivative flow from the pump curve, which will be much more accurate than a set pump capacity under these conditions.

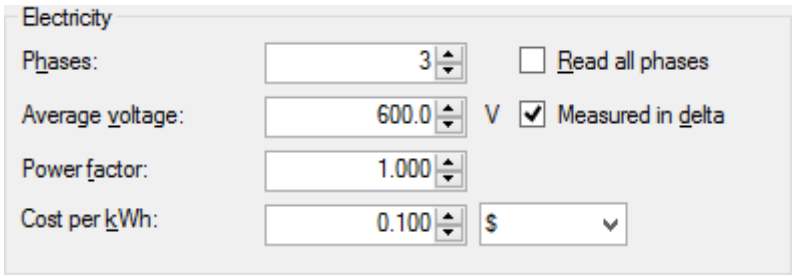
Volumetric is a function of Volucalc RT and is not available on the Volucalc VS.



The **Read variable speed pumps current** window allows for per pump, global or none selections.

Per pump means that there is a current sensor per pump. This is only if there are 2 pumps or less.

Global means that there is one current sensor for all pumps, normally placed on the electrical input of the control panel. In this case, the power consumption is distributed according to the pump flow. This is only if there are 3 pumps or less. Select **None** if there are no sensors installed.



The **Electricity** section allows you to enter parameters used to calculate the power consumption of the pumps. The values are specific to the electrical configuration of each station. They are also dependent on the number and type of pumps used. The estimation of kilowatts consumed by a pump is the result of Current x Voltage x Power Factor.

If there is only one pump, then it is possible to place a current sensor per phase. In this case, ☐ Read all phases must be checked.

The majority of pumps used in sewer collection and water distribution systems have three phases. If this is the case, let the number of **Phases** be 3. If a current sensor is installed on only one of the 3 wires powering the pump, 3 indicates the current multiplier for estimating the total power usage of the pump. If the pump has two phases (240 volts), then choose 2 and 1 phase for most 120 volts pumps.

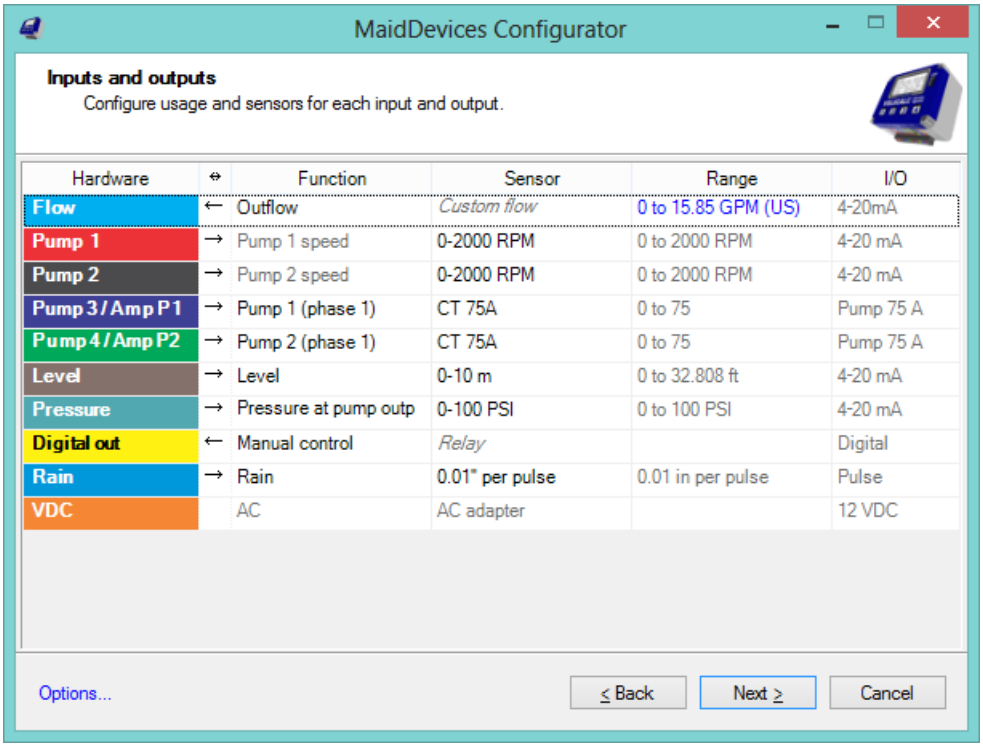
The **Average voltage** of the pumps is normally measured from phase to phase, which is called delta. If the voltage was measured between a phase and ground, then uncheck ☐ Measured in delta. Enter the average voltage of the phases on that line.

The **Power factor** is normally found on electricity bills as well as the **Cost per kWh**. These are only used to estimate the power consumption and operation cost. The last box is the currency symbol to use: $, €, £, or ¥.

Click Next ≥ to continue.

Inputs and Outputs

The **Inputs and outputs** dialog is directly related to the choices of the previous dialog relating to pumps, algorithm and current reading. Choices are normally available by clicking in the appropriate cells. This table is the best way to check all the possible combinations.

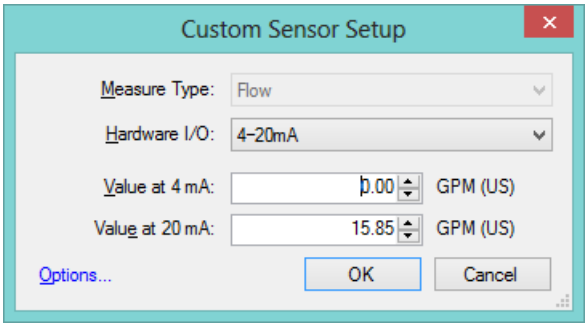


The left arrow ← means the signal is an output and to the right → means it is an input.

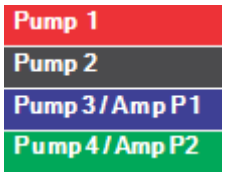
Flow

The analog 4-20mA **Flow** output is proportional to the outflow calculated from the pumped curves or pump capacities. It can also include the lost water caused by an overflow event if calculated using one of the open channel equations. This output must first be configured by the user. The configuration window will appear by clicking the **Range** field.

In this window, **Value at 4 mA** and **Value at 20 mA** can be selected or changed with the arrows or by entering corresponding values. The user must ensure that the measurement unit shown is correct. This can be changed by clicking on the **Options** link ... All similar windows work the same way.



The 4-20 mA loop is powered by internal 12VDC. No external power is required.



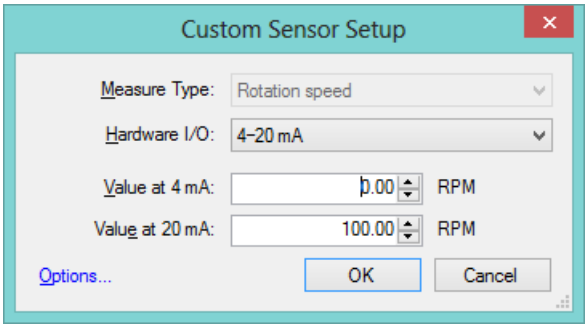
The input configuration for pumps 1, 2, 3 and 4 depends on the selected number of pumps in the Lift station dialog (page 37) window. The table below shows the various combinations of inputs based on the number of pumps in the station.

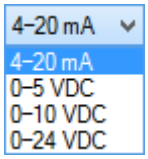
RPM and **AMP** indicates the pump input is used to measure pump speed or current. Bold letters indicates this field is not optional. Italic is optional.

RPM is the number of pump revolutions per minute which is an output from the variable frequency drives controlling pumps. **AMP** indicates a current sensor is used to measure the pump current.

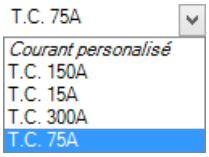
Nb of pumps	1		2		3		4	
Types of pumps	**Variable**	**Fixed**	**Variable**	**Fixed**	**Variable**	**Fixed**	**Variable**	**Fixed**
Pump 1	**RPM**	**AMP**	**RPM**	**AMP**	**RPM**	**AMP**	**RPM**	**AMP**
Pump 2	*AMP*	*AMP*	**RPM**	**AMP**	**RPM**	**AMP**	**RPM**	**AMP**
Pump 3/Amp P1	*AMP*	*AMP*	*AMP*		**RPM**	**AMP**	**RPM**	**AMP**
Pump 4/Amp P2	*AMP*		*AMP*		*AMP*		**RPM**	**AMP**

To configure the speed input of a pump, three choices are available, or **0-1000 RPM**, **0-2000 RPM** and **Custom speed**. When **Custom speed** is selected by clicking in the **Range** column, the **Custom Sensor Setup** window appears.



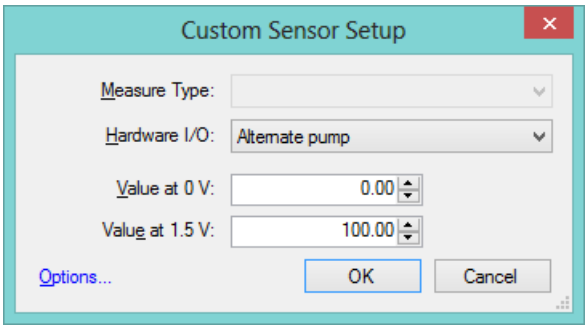


The **Hardware I/O** allows you to choose between the following analog inputs: 4-20mA, 0-5VDC, 0-10VDC or 0-24VDC. Depending on the configuration, the user must enter the RPM relative to the measurement limits of this input.

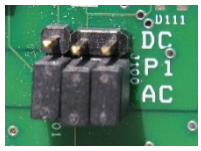


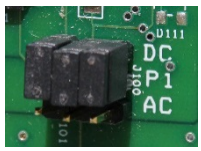
When recording the current is desired, selecting the Current Transformer (**CT**) is done using the drop-down menu in the **Sensor** column. The available standard sensors are in **15A**, **75A**, **150A**, **300A**, or a **Custom current**.

When a custom sensor is required, the user must enter the number of amperes corresponding to the limits of Volucalc VS input, which is 1.5 volts.



The selected sensor is displayed in the **I/O** (input/output) column, which is **15A**, **75A** or **Alternate** for all other types of sensors. Place the pump input switches (next page) at the proper positions on the device (15A, 75A, ALT) by means of a small screwdriver or a paperclip.





It is very important to correctly place the jumpers on the inside of the device according to the use of the input. When input sensors are level, pressure, speed or flow, the jumpers in the VS must be on "DC." For all standard current sensors, the jumpers should be on "AC".

Level

The analog input **Level** is configurable in the **I/O** column. The choices are **4-20mA**, **0-5V**, **0-10V** and **0-24V**. The choice of sensors include: **0-10 m**, **0-20 ft** or **Custom level**. In this case, the Configuration window of a custom sensor appears by clicking in the **Range** field.

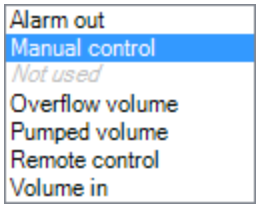
By using the Function column, several functions can be assigned to this input and recorded. The **voltage** of a external battery (battery condition), the **water pressure**, the **pressure at the inlet of a pump**, the **pump speed** or **not used**. The most common and default feature is the **Level**.

Pressure

The analog input **Pressure** is configurable in the **I/O** column. The choices are **4-20mA**, **0-5V**, **0-10V** and **0-24V**. This is used to read the outlet pressure for the pumps, not a single pump. The sensor ranges include: **0-100 PSI**, **0-300 PSI** and **Custom sensor**. In this case, the configuration window will appear by clicking in the **Range** field. In the Function column, several other functions can be assigned to this entry as explained in the preceding paragraph.

Digital out

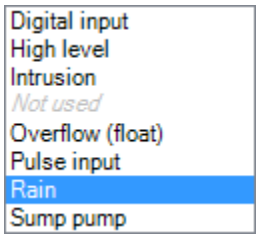
The **Digital output** can be used in different ways. As an **Alarm output**, it allows you to configure an alarm on minimum and/or maximum values. The alarm relay contacts will close when generating an alarm. The configuration of alarms is at page 23.



The **Remote control** function allows control of an alarm through the MaidMaps software. A connection is required to the Internet via the Ethernet port of the instrument. The bandwidth options may affect the rate at which the command is received and executed by the VS.

Manual control disables alarms and opens and closes the relay manually from a command entered by the user on the device.

The functions of **Overflow volume**, **Pumped volume** and **Volume in** will energize the relay contacts close for one second (create a pulse) each time the selected type of volume in the **Range** field is calculated (1 pulse = volume selected).



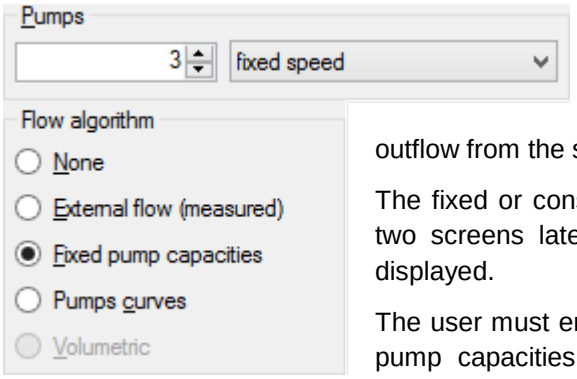
Rain

The **Rain** input normally is used to record rainfall which is most common. However, it is a Digital input and can be used for other types of input selections. Some of these are **High level** (float), **Intrusion** (alarm), **Overflow** (float) and **Sump pump** operation.

VDC

The VDC input requires a 12Vdc power source for the instrument. The same 12Vdc is used to power the 4-20mA output proportional to the calculated flow rate.

Fixed speed pump capacity

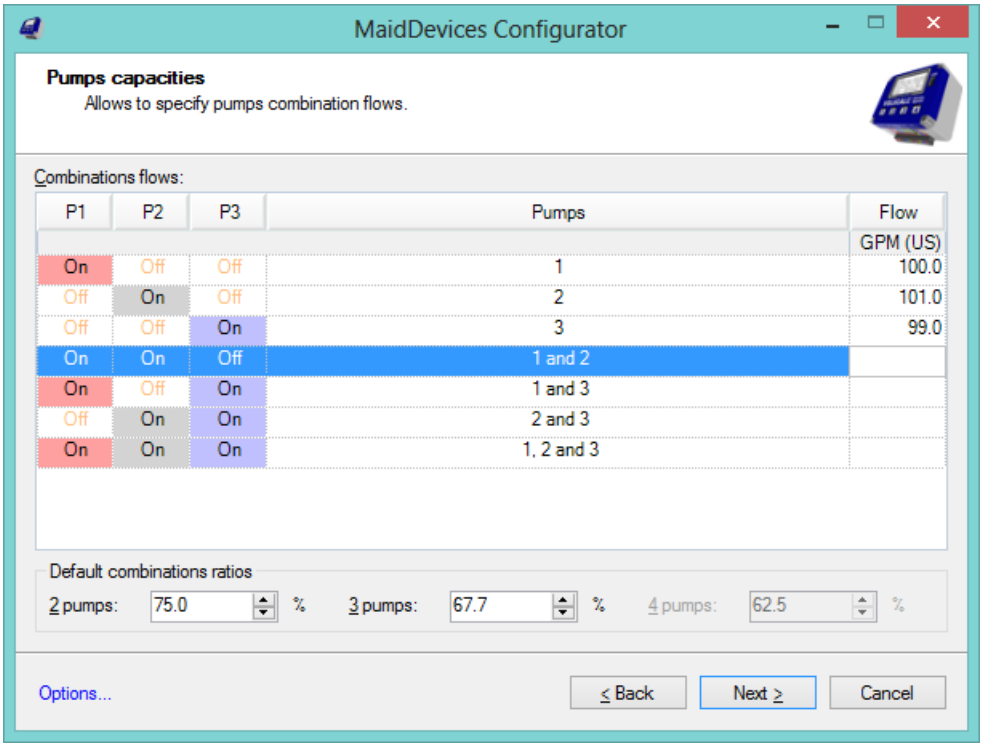


In the **Lift station** dialog window, when all pumps are constant speed, the flow algorithm will use the preset pump capacities. Based on run times for each pump, the total volumes per pump and total volumes pumped (all pumps) will be calculated as outflow from the station.

The fixed or constant speed **Pump Capacities** dialog window (next) will appear two screens later, and the **Pump Curve Selection** dialog (next page) is not displayed.

The user must enter each pump capacity in the **Flow** column. Please insure the pump capacities values were taken during normal operational levels. If the capacities of pump combinations are known, then it should be entered as well.

During a drawdown procedure to calculate a pump's capacity or combination of pumps, insure the levels (Lead/Lag, Start/Stop) are the same levels used for daily operations of the station. This will provide the most accurate capacity information for the Volucalc VS.



The **Default combinations ratios** selections area provides a general rule of thumb for standard pump capacities when an actual drawdown test has not provided this information.

Note: The standard default is 1 ½ times the average pump capacity for two pumps which equals 75%. A triplex station would be 67.7% the average pump capacity. Of course these values, which can be changed, are a general rule and do not replace an actual drawdown calculation.

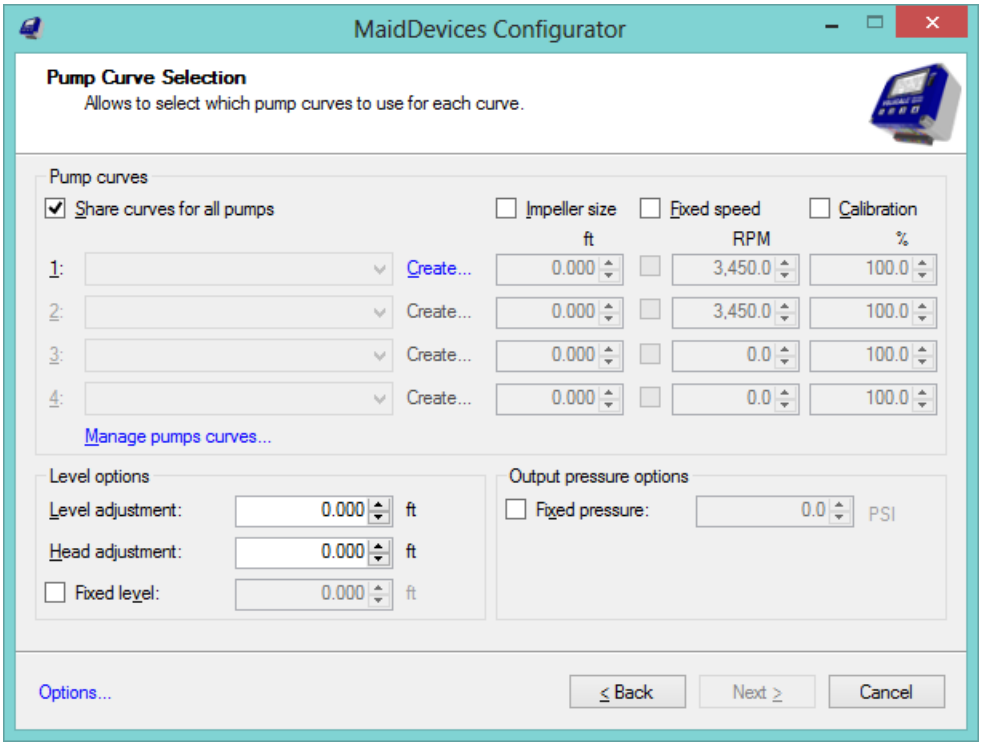
Pump Curve Selection

This dialog window (next page) is used to create and select the curves for variable speed pumps.

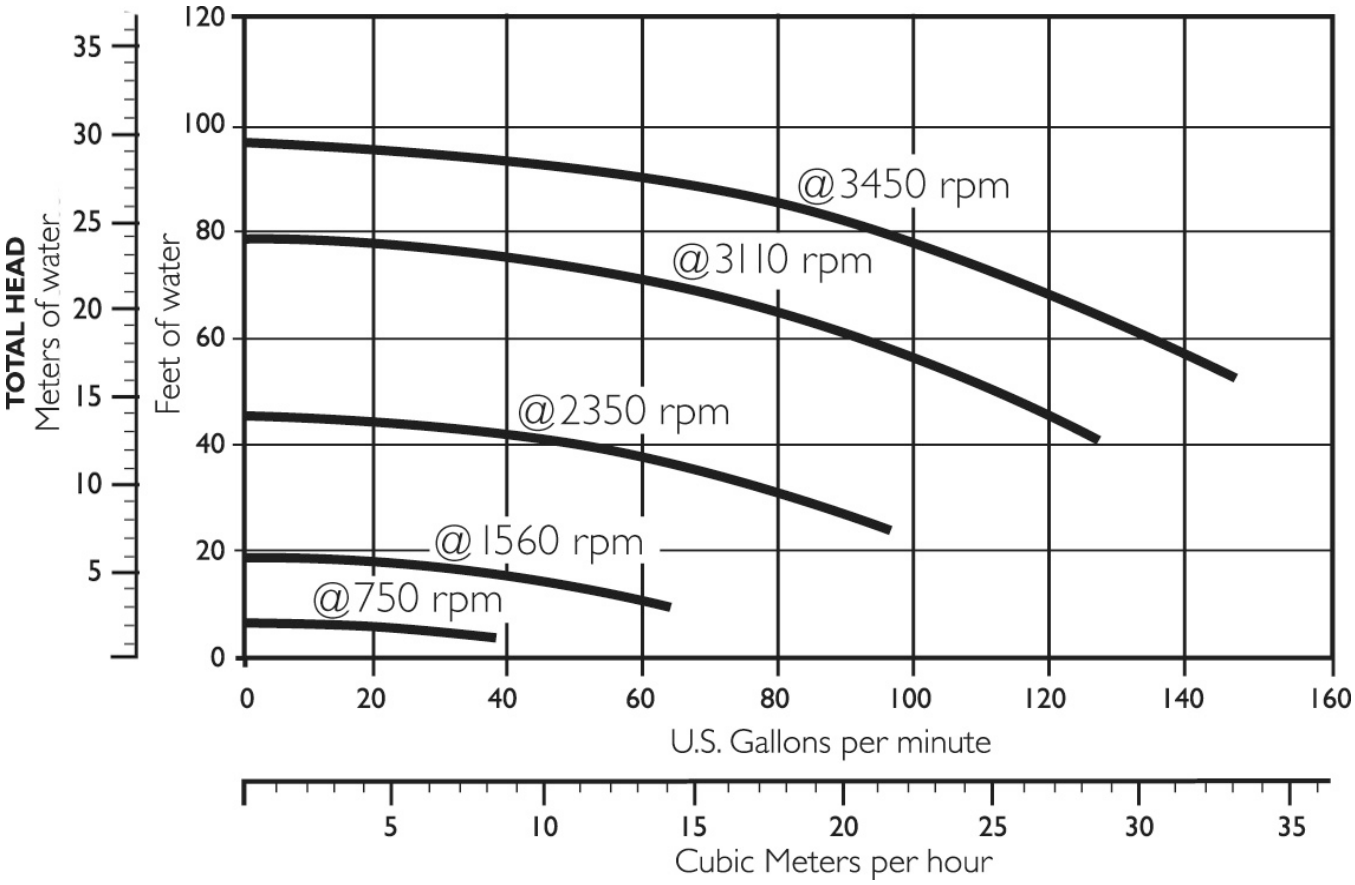
If all pumps are identical, you can use the same pump curve as pump no. 1, check ☑ Share curves for all pumps. In this case, only the first pump field 1: needs to be configured.

If the pumps have different curves and have not been interred into the Configurator software, you can create new curves for each pump. The pump curve data is stored in the software and can be reused with different site files using the same pump types.

The pump curves are usually provided free from the manufacturers. They represent flow rate relative to the head condition. Variable speed pumps have several curves in the graph for multiple RPM. Note: Before creating curves in the Configurator, it is important to have these curves in the computer and in a graphic format. The pump curves images should be displayed in a large format.

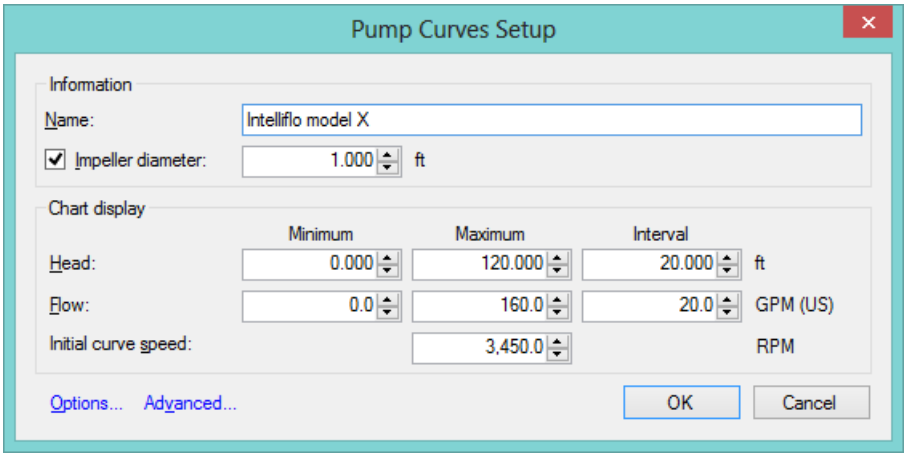


EXAMPLE OF PUMP CURVE : MODEL INTELLIFLO



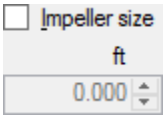
Once the pump curves is found (picture above), in the **Pump curves** area, click **Create ...** for the corresponding pump and the **Pump Curves Setup** dialog window will appear.

Configure the units according the graph pump curve information provided, even if it is only temporarily. The Configurator will do the conversion back, when needed. To change the units, click on the **Options…** link.



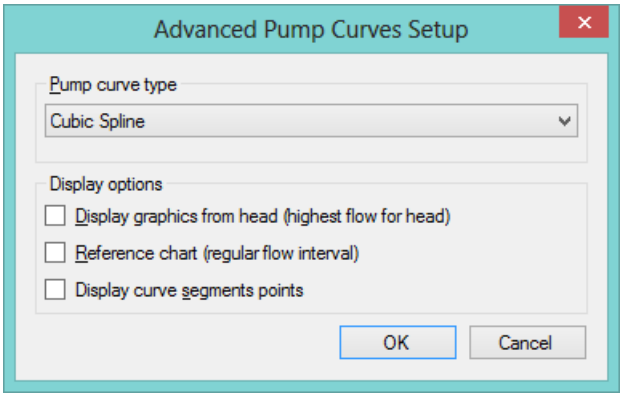
Each pump curve created in the Configurator for a specific pump model can be reused for other pumping stations. It is important to give them a meaningful name.

When the diameter of the impeller is known, it can be entered as part of the curve. If a different impeller diameter is used and entered in the **Pump Curve Selection** dialog (previous page), then the calculate flow will be automatically adjusted according to updated data on the impeller's diameter.



To create pump curves in the Configurator, enter the minimum and maximum values for the X-axis (flow) and Y (head) from the pump curve graph (like on the previous page) and the value for the intervals in the appropriate fields. Set a speed at which the first curve will be created in the **Initial curve speed** field.

The **Advanced …** link will change the way curves are displayed. The best configuration is the default, which is **Cubic Spline** without any **Display options** selected.

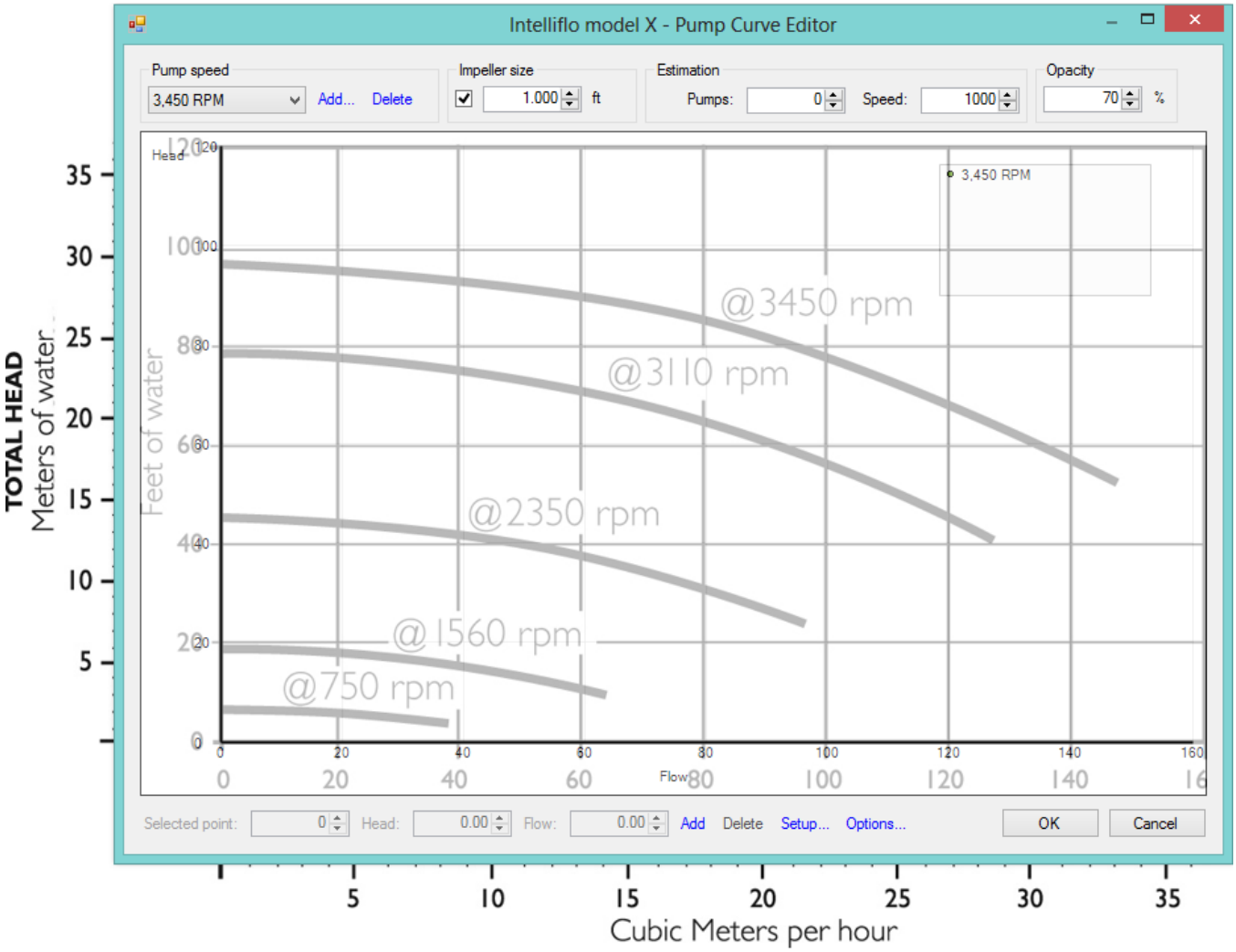


Click OK to go to the next step and the **Pump Curve Editor** window (next page) will appear.

Pump Curve Editor

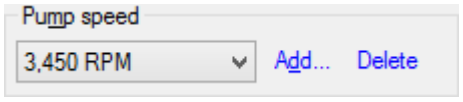
The **Pump Curve Editor** provides a semi-transparent window to overlay and copy curves. Stretch the editor window over the manufactures pump curves graph and behind the pump curve editor window.

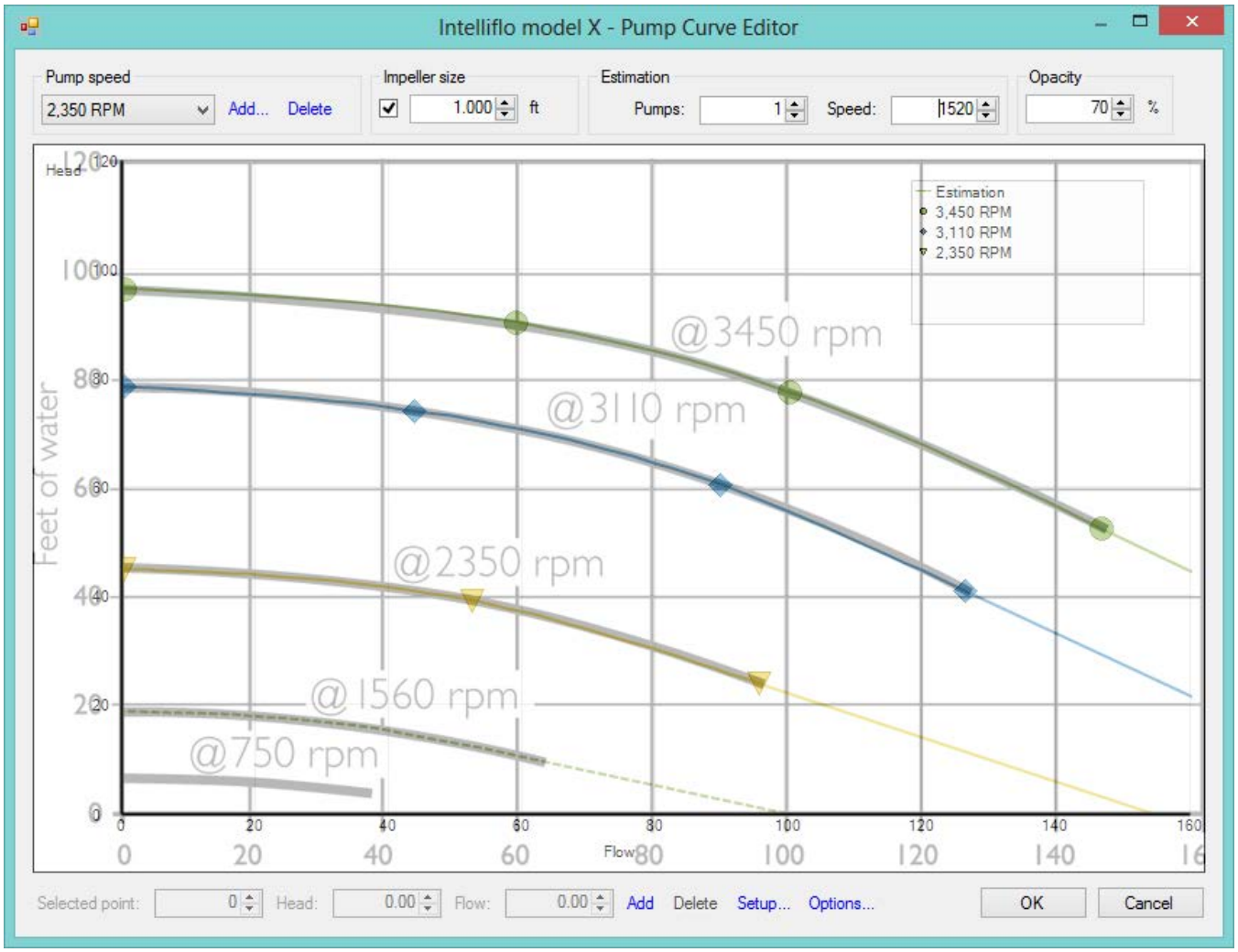
You may want to adjust the opacity of the window of the overlay screen while directly over the pump curve graph to see the data more clearly. The smaller percentage of opacity makes the window more transparent.



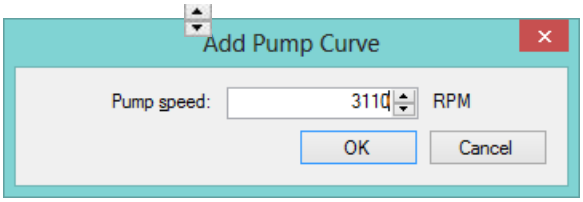
When overlapping the windows, be sure to use identical scales and adjust the window size for a perfect overlay of the graph of the pump curve document. Place the origin of the axes over each other to start and stretch the top and right sides of the **Pump Curve Editor**.

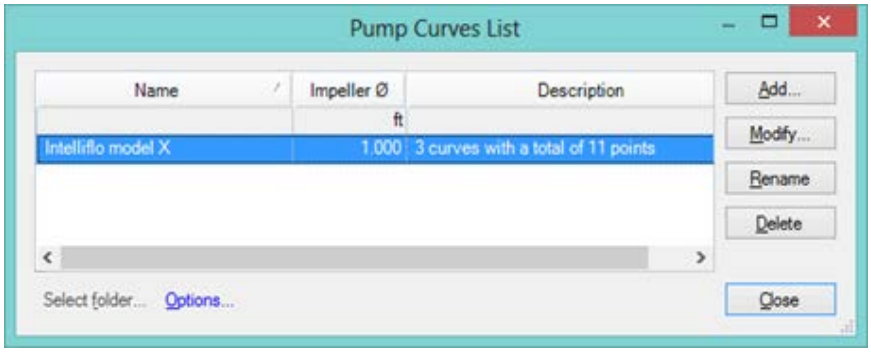
After the axes and intervals are properly aligned, align the pointer of the mouse to the absolute left of the curve related to the Pump speed. Double-click the mouse left button to create a first point at zero flow (the x-axis is zero) for the RPM entered in the previous screen (shown in the upper left corner of the curve editor). Create a second point in the middle of the curve and a third and final point at the end of the curve. A curve connecting the three points will be at the screen. If necessary, add additional points on the curve to an almost perfect superposition. It is possible to enter and clear head / flow points at the bottom of the curve editor.



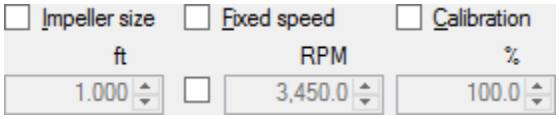


You can create up to four curves for different speeds. After creating the first curve, it is recommended to do a curve scan using the dotted curve created in the **Estimation** section (top right). In the **Pumps** field, enter 1 and then change the **Speed** using the arrows. The dashed curve will shift depending on the speed variation obtained with the arrows. The superposition of the dotted curve with the different curves in the graph will determine whether the addition of a second curve is required. If this is the case, the **Pump speed** section, click the **Add ...** and enter the RPM for which the second curve must be created and use the same steps as before to create the new curve.





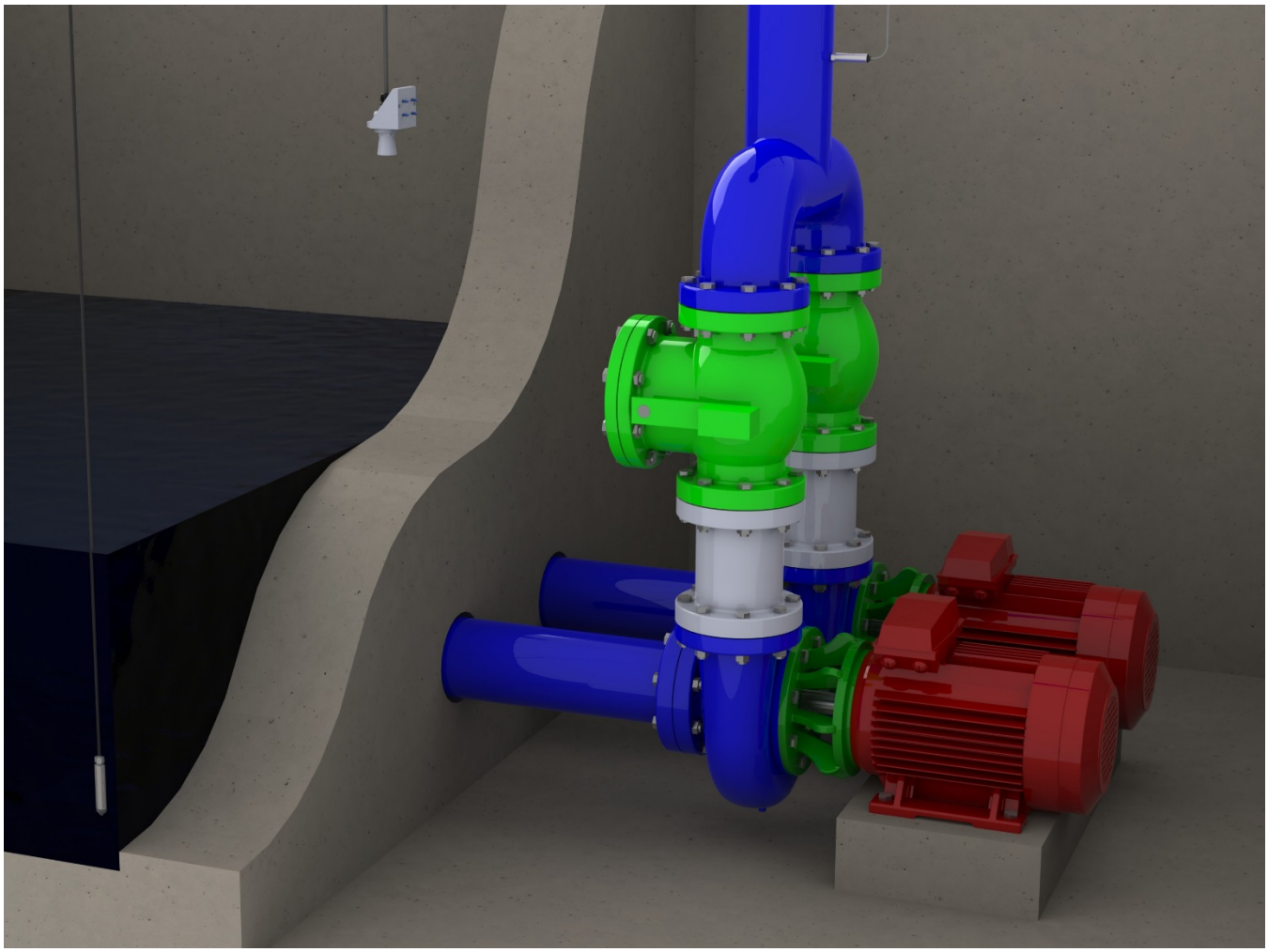
The user will automatically return to the **Pump Curve Selection** dialog window (Page 40). It is possible to **Add**, **Modify**, **Rename** and **Delete** pump curves by clicking the **Manage pumps curves ...** link.



After accepting the pump curves, return to the initial screen of the **Pump Curves Selection**. These are advanced impeller settings and only used when the impeller may be worn or not the original impeller do to maintenance requirements. The setting will compensate for the impeller size, speed or calibration. These adjustments will only affect the system curve and not the pump curve you may have loaded into the software. On the right, you can enter the true diameter of the impeller.

If only constant speed pumps are used, then this does not apply.

To complete the **Pump Curves Selection** dialog, this picture is used to explain the **Level options** and **Output pressure options**.



The **Level options** allows you to enter values to compensate abnormal readings.

Level adjustment is the difference in height between the level 0 set (page 48) and the level of the pumps. This value should be a positive number if the pump is below the level 0.

Head adjustment is similar, but for the head this time. A positive number indicates that the sensor is higher than the pump.

☐ Fixed level: or ☐ Fixed pressure: is when to force a value (no sensor or faulty sensor) is needed. If no sensor is configured, it is necessary to specify the level or fixed pressure as appropriate.

VOLUCALC™ VS Calibration worksheet

If you do not have the curves for the variable speed pumps, then they must be created. If you have them, then you can check the system curve. The flow accuracy of the VOLUCALC ™ VS is directly proportional to the quality of the calibration performed. MAID Labs provides an Excel worksheet on the USB key or downloaded from Maid Labs' website through this link www.maidlabs.com/Files/VS_Calibration_worksheet_GPM.zip. It is explained on next page.

This is how the Calibration of the Volucalc VS works:

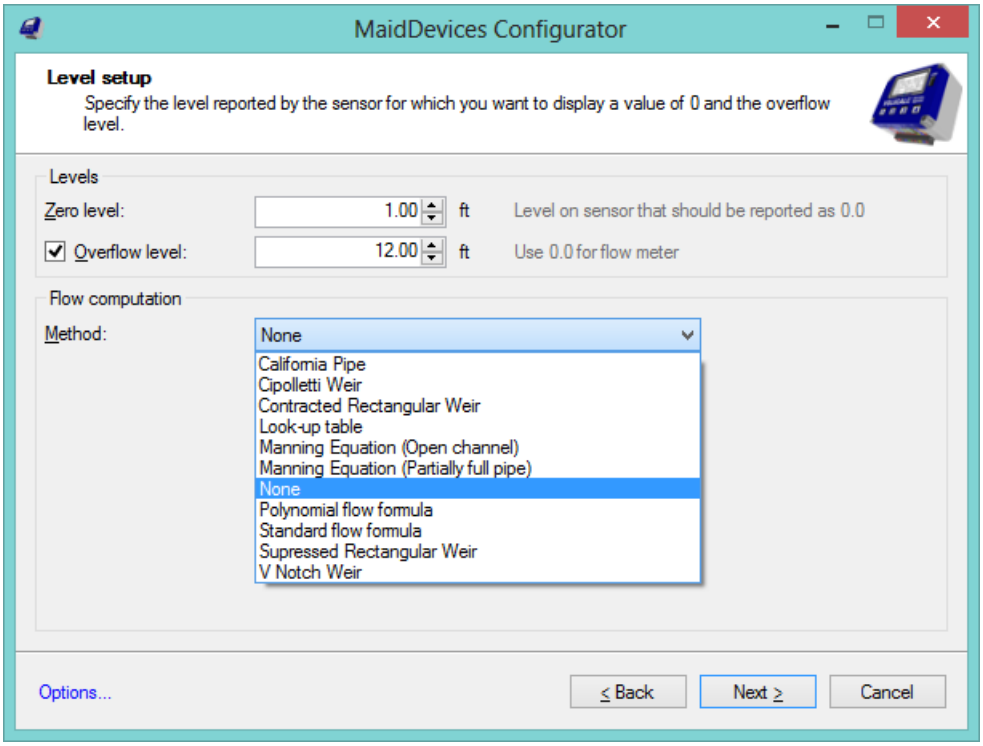
- It takes one curve per speed, preferably low, medium and high speed, 3 speeds are required.
- Run the pumps at the each speed within a known volume.
- The start and stop levels used should be in the middle of the normal operating level for the variable speed pumps. For example: If the normal is set at 10.0' then the stop should be 9.5' and the start 10.5'.
- Manually start and stop the pumps at each level for each pump and for each speed. Then enter the run time in the spreadsheet to calculate the flow rate of the pump.
- Repeat the process as many times as time allows it to generate good average results.
- Create the flow curves in the Configurator.

This is important to have the same distance above and below the average level at which the pumps usually operate. If the distance between the levels is too high, it will take forever to do the calibration. If the distance is too small, the accuracy will be reduced. 5 to 15 minutes fill-up time is good. Perform a fill-up cycle to calculate the average flow before the pump operation.

	A	B	C	D	E	F	G	H
1	**Volucalc VS Calibration**					Enter data in grey area only		
2	**Name of Lift Station:**							
3	**Install a Volucalc VS with level and pressure sensors.**							
4	**Calibrate all the sensors (with Maid Devices configurator).**							
5	**Enter well dimensions** (surface in feet)				**Dim. 1:**		**Dim. 2:**	
6	Select start and stop levels that will be used during the tests. If possible, try to have the same distance above and below the average level at which the pumps usually operate. If the distance between the levels is too high, it will take forever to do the calibration. If the distance is too small, the accuracy will be reduced. 5 to 15 minutes fill-up time is good. Do a first fill-up cycle to calculate the average flow before the pump operation.							
7	**Measure the distance between these levels.**						**Distance:**	
8	**Volume of well (ft^3)**		0				**Gallons:**	-
9	Compute all the data and create pump curves and setup this in the MaidDevices							
11	**Pump #**	**SPEED**	**RPM**	**Pump Start HH:MM:SS**	**Pressure**	**Pump Stop HH:MM:SS**	**Time Period HH:MM:SS**	**Flow Rate GPM**
12	1	LOW					0:00:00	
13	1	LOW					0:00:00	
14	1	LOW					0:00:00	
15	1	Intermediate					0:00:00	
16	1	Intermediate					0:00:00	
17	1	Intermediate					0:00:00	
18	1	High					0:00:00	
19	1	High					0:00:00	
20	1	High					0:00:00	
21	2	LOW					0:00:00	
22	2	LOW					0:00:00	
23	2	LOW					0:00:00	
24	2	Intermediate					0:00:00	
25	2	Intermediate					0:00:00	
26	2	Intermediate					0:00:00	
27	2	High					0:00:00	
28	2	High					0:00:00	
29	2	High					0:00:00	
30	1 + 2	LOW					0:00:00	
31	1 + 2	LOW					0:00:00	
32	1 + 2	LOW					0:00:00	
33	1 + 2	Intermediate					0:00:00	
34	1 + 2	Intermediate					0:00:00	
35	1 + 2	Intermediate					0:00:00	
36	1 + 2	High					0:00:00	
37	1 + 2	High					0:00:00	
38	1 + 2	High					0:00:00	
39								

2 pumps GPM | 3 pumps GPM

Level setup



This window allows you to select and configure the calculation method for open channel flow and set the overflow level. To get access to open channel **Flow computation** functions, **Overflow level** must be checked.

The **Zero level** represents the difference between the value read by the probe and the level being displayed as zero. If the probe is placed at the height of the pump and the pump stops one foot above, but the user would like to see zero when the pumps stop, then 1 should be written at **Zero level**. This value must be positive value.

When **Overflow level** is checked, the overflow calculations, for open channel flow and recording overflows are functional and available. The value entered for **Overflow level** is the level from which the selected open channel calculation should be performed and recorded.

When **None** is selected, the sensor records the overflow level, but no flow or volume are calculated.

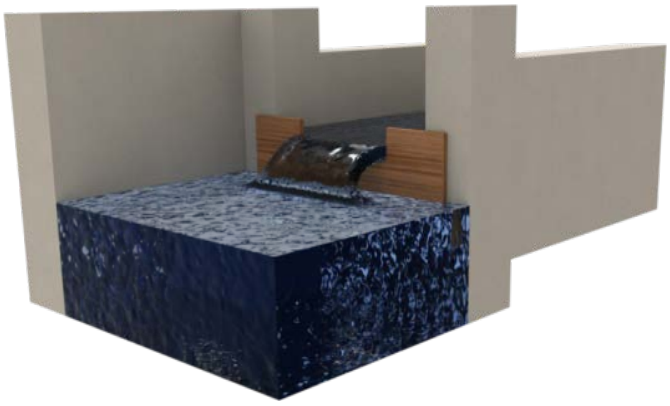
Flow computation formulas

All flow formulas have their advantages and disadvantages. Choosing the one that gives the best results given the installation's limitations is the responsibility of the user. Marcel Roche wrote in SURFACE HYDROLOGY: "Being convinced that poor measurement is better than a good calculation, you should never hesitate to measure".

Conditions for implementation of weirs:

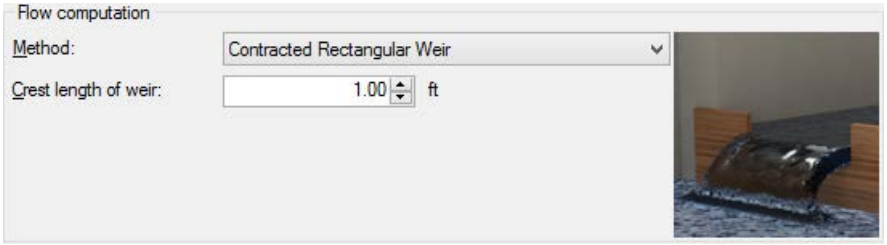
- The plate must be perfectly vertical and perpendicular to the sides of the incoming channel, waterproof and crushproof.
- The incoming channel must be straight, uniform, and rectangular with a constant slope over a length greater than 10 times the width of overflowing water in the channel at maximum load.
- The water level in the downstream channel must be sufficiently below the highest point of overflowing water to ensure a free flow and be fully ventilated.

Contracted Rectangular Weir and Suppressed Rectangular Weir



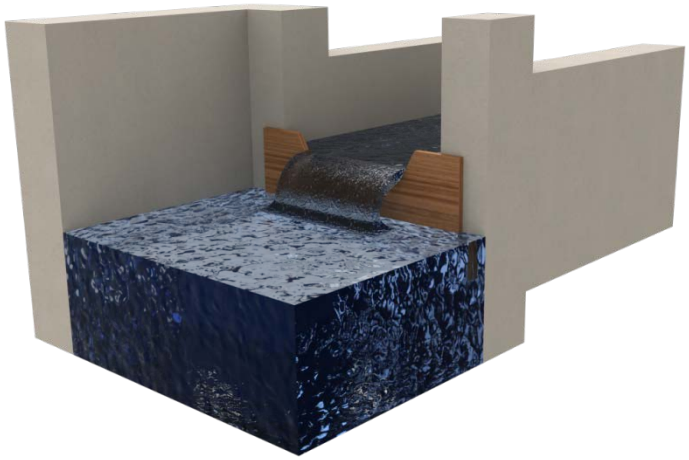
The accuracy of rectangular weirs, with or without contractions, is usually between 1 to 4% of the flow coefficient when all conditions are met.

The **Crest length of weir** parameter is required.

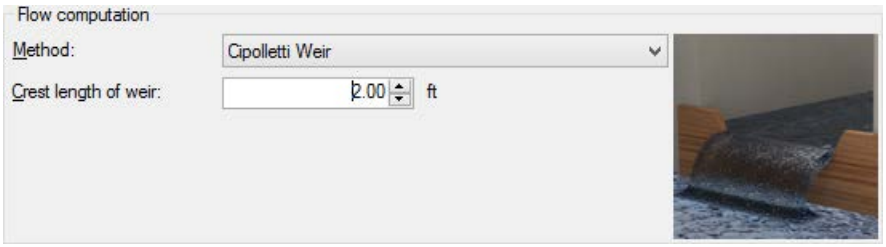


Trapezoidal Weir (Cipoletti)

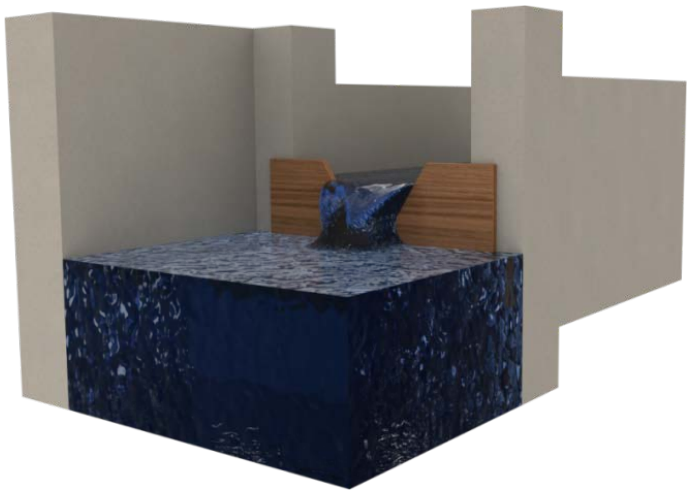
The accuracy of the trapezoidal weir or Cipoletti is the order of 1 to 4% of the flow coefficient when all conditions are met.



The **Crest length of weir** parameter is required.



V Notch Weir

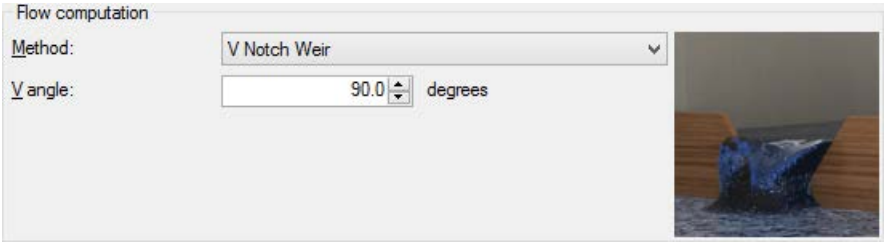


The accuracy of the triangular weir is on the order of 1 to 2% of the flow coefficient when all conditions are met.

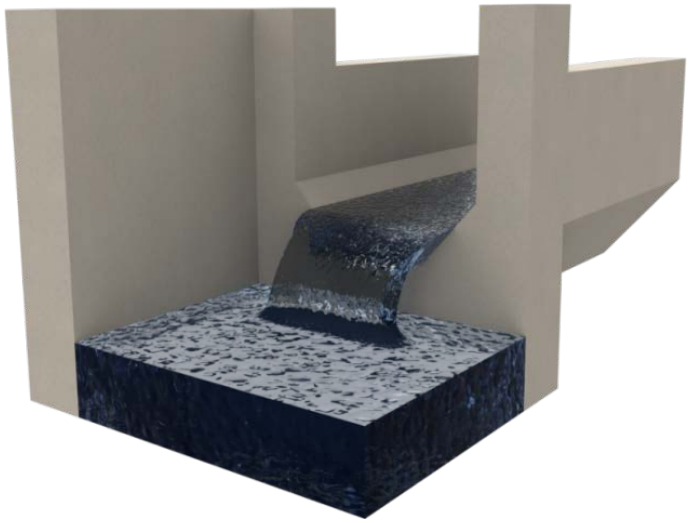
To maximize the chances of achieving this degree of accuracy:

- The distance between the base of the channel and the tip of the V should be twice the distance between the tip of the V and the surface of the water.
- The distance between the sides of the channel and the top of the V should be twice the distance between the tip of the V and the surface of the water.

The **V angle** parameter is required.

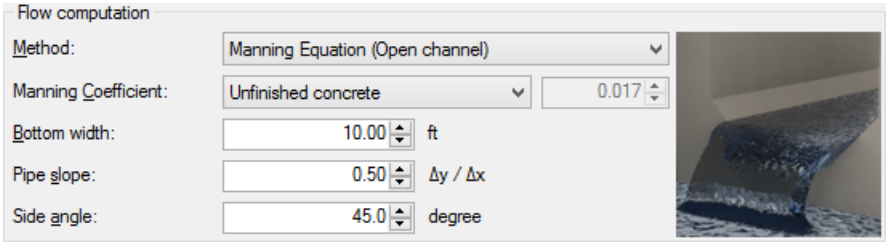


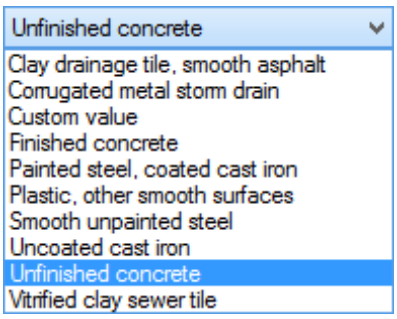
Manning Equation (Open channel)



This type of channel is often encountered in literature as a good to calculate flow in overflow conditions.

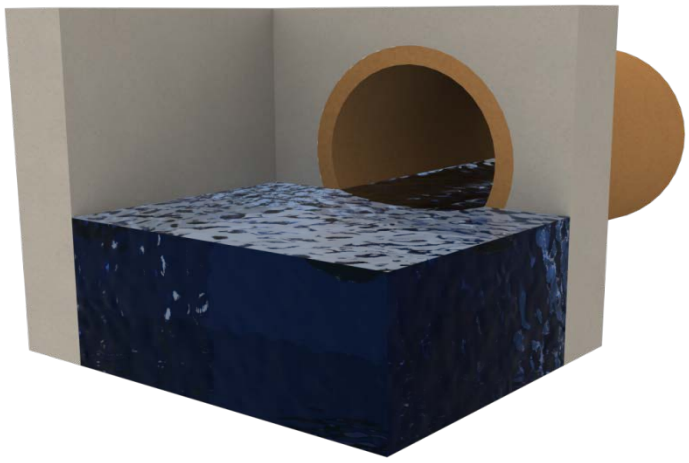
The **Manning Coefficient**, **Bottom width**, **Pipe slope** and **Side angle** parameters are required:





Manning Equation (Partially full pipe)

This equation is the easiest to use to assess the volume and flow lost in an overflow. The Manning equation is usually like this:



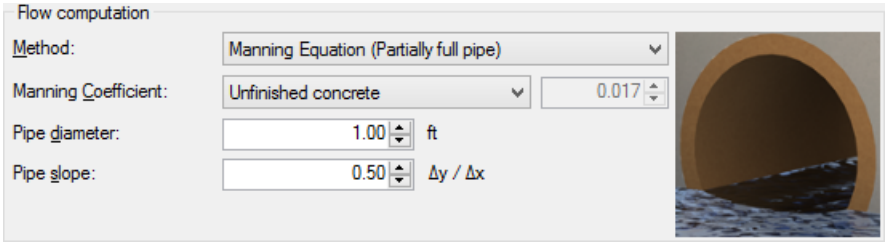
$$Q = \frac{KAR^{\frac{2}{3}}S^{\frac{2}{3}}}{n}$$

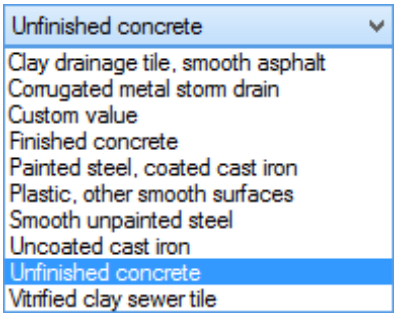
Q = Flow Rate
K = Coefficient relative to the units used in the equation
A = Area of the submerged part of the pipe
R = A divided by the perimeter of the submerged section
S = Slope of pipe
n = Coefficient representing the degree of roughness of the pipe wall.

The Manning equation is used to estimate the flow in open channel situations where it is not practical to construct a weir or channel to measure the flow with greater accuracy.

This equation was developed to calculate the flow in locations where the water flows at a speed relative to the angle of the pipe roughness and the depth of water. When water escaped from a tank, as for an overflow pipe located in pumping station, an error could be induced because the equation is not optimized for this type of installation, but it is the only one available.

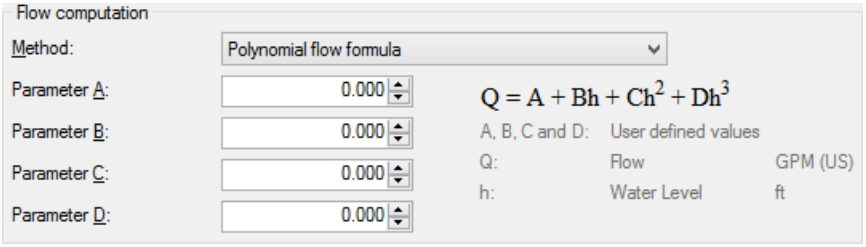
The **Manning Coefficient**, **Pipe diameter** and **Pipe slope** parametres are required.





Polynomial Flow Formula

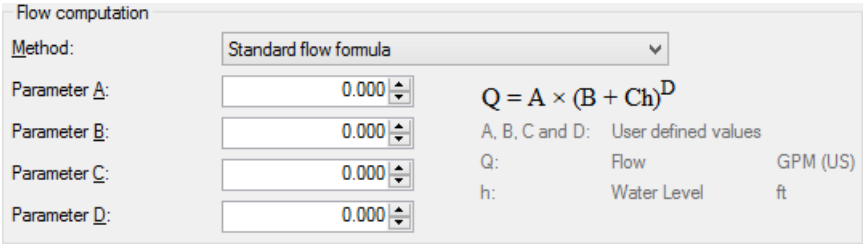
The majority of the formulas of flow can be summarized in two equations, standard flow and polynomial flow. Note that the settings of the following units are in feet (ft) for the height and cubic foot (ft^3) for flow.



Standard Flow Formula

All the following tables are based on this formula, with the exception of the Polynomial formula.

We assume that the user has the knowledge to choose the most suitable Equation for the system on which the product will be installed.



Channels

H Channel	A	B	C	D
0.50	1.60	0	1	2.2
0.75	1.77	0	1	2.23
1.00	1.95	0	1	2.30
1.5	2.12	0	1	2.30
2	2.37	0	1	2.23

Parshall	A	B	C	D
1”	0.338	0	1	1.55
2”	0.676	0	1	1.55
3”	0.992	0	1	1.55
6”	2.060	0	1	1.58
9”	3.070	0	1	1.53
12”	3.950	0	1	1.55
24”	8	0	1	1.55
36”	12	0	1	1.57
48”	16	0	1	1.58
60”	20	0	1	1.59
72”	24	0	1	1.59

Palmer-Bowlus	A	B	C	D
4”	1.73	0.00588	1	1.957
6”	2.071	0.005421	1	1.903
8”	2.837	0.01456	1	1.972
10”	2.843	0.01616	1	1.953
12”	3.142	0.017	1	1.936
15”	3.574	0.0168	1	1.906
18”	3.988	0.01875	1	1.898
24”	4.574	0.0408	1	1.950
30”	5.022	0.0625	1	1.966
36”	5.462	0.08	1	1.991

Trapezoidal	A	B	C	D
60º	1.55	0	1	2.58

Polynomial	A	B	C	D
0.4HS	-3.48e-5	2.1e-3	3.52e-1	4.40e-1
0.6HS	-7.52e-5	8.3e-3	4.02e-1	3.79e-1

Weirs

Triangular	A	B	C	D
22.5º	0.505	0	1	2.500
30º	0.676	0	1	2.500
45 º	1.028	0	1	2.500
60 º	1.420	0	1	2.440
90 º	2.490	0	1	2.475
120 º	4.333	0	1	2.500

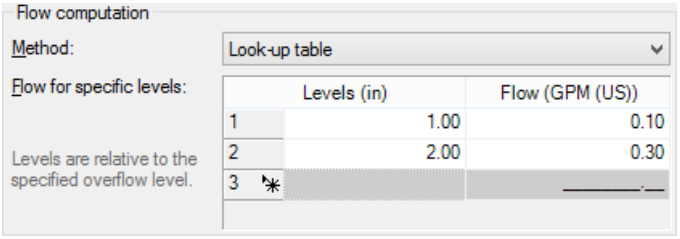
Trapezoidal	A	B	C	D
0.5’	1.684	0	1	1.5
1.0’	3.367	0	1	1.5
1.5’	5.051	0	1	1.5
2’	6.374	0	1	1.5
3’	10.101	0	1	1.5
4’	13.468	0	1	1.5

Rectangular	A	B	C	D
1’	3.333	0	1	1.5
2’	6.667	0	1	1.5
3’	10.00	0	1	1.5

Lookup table

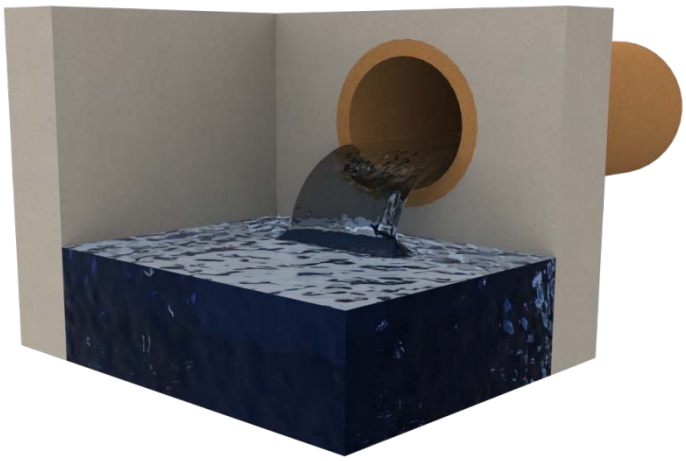
When no type of weir, channel or formulas to calculate flow with reasonable accuracy, but that a flow rate proportional to the height of the liquid is known, at least at specific heights, then the Lookup table is the function to use.

Up to 100 levels with corresponding flow rates can be entered in the table. Press the ✳ to add a **Level** and corresponding **Flow** rate. Entered values cannot be deleted or sorted, so enter them correctly.

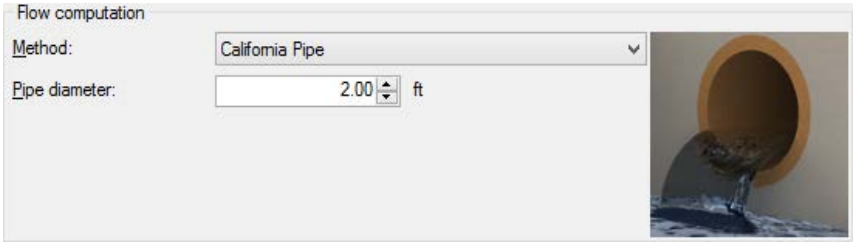


California Pipe

This method measures the output of the open end partially filled horizontal pipe which will discharge freely into the air. This method is sometimes considered to be a method of trajectory. However, the measure is really based on the depth at the end of the pipe.

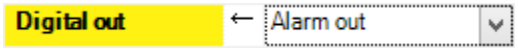


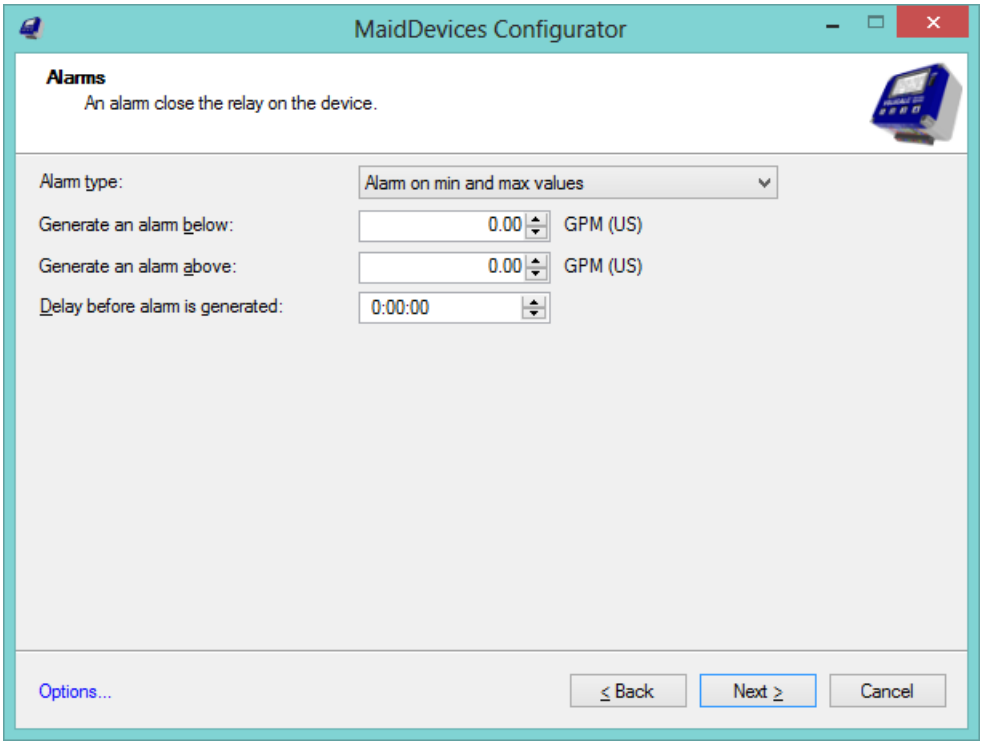
The **Pipe diameter** is required:



Alarms

In the **Inputs and Outputs** dialog window (page37), when the **Digital output** function **Alarm out is selected** the following dialog window becomes available and allows you to enter values above and or below which the relay can be activated.





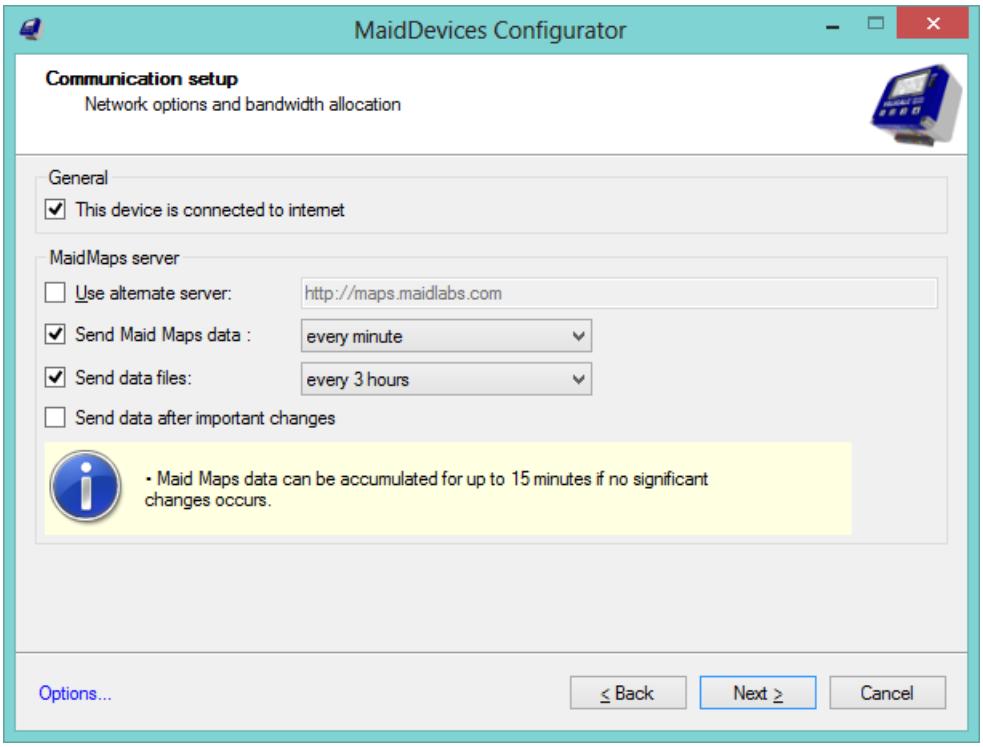
Alarm on the minimum value only means an alarm is generated when the measurement read or calculated is at or under the value entered in the field **Generate an alarm below** for a duration determined by the field **Delay before alarm is generated**.

The other choices are **Alarm on the maximum value only** and **Alarm on the minimum and maximum values**.

Communication setup

The VOLUCALC™ VS can transmit data to a Web server and be viewed in real time. The data will be displayed in the MAID Labs Technologies software known as MAID Maps.

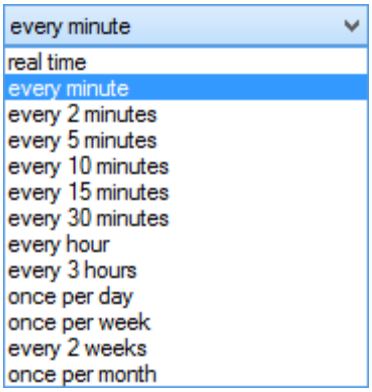
Depending on the bandwidth quality, communication with the server will be fast or slow. In the **General** section, when **The device is connected to the Internet** is not checked, the communication will not work. This mode also disables the Ethernet module, which

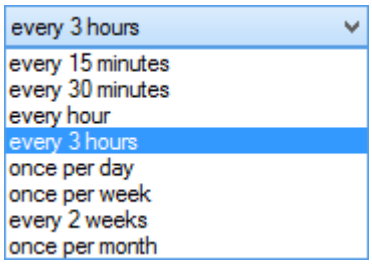


allows options in an "offline" mode like manually adjusting the time (page 20). By checking this box, different configuration options are anabled.

The default Web server is http://maps.maidlabs.com. However, it is possible to use another server by checking **Use alternate server** box and supplying a valid server address running Maid Labs software MAIDMAPS.

Send Maid Maps data is used to send what is been read or calculated by the instrument based of the user's time frame requirements selected from the list to the right.





Send data files is used to send mostly reports based of the user's time frame requirements selected from the list to the left.

Then **Send data after important changes** is checked, when and alarm or overflow occurs, an immediate communication will be generated to the MaidMaps server. Based on its own settings, MaidMaps might send an email to the person who can take care of the situation.

The minimum duration of an overflow event is 3 minutes. If the overflow is shorter than that, no events will be sent to MaidMaps.

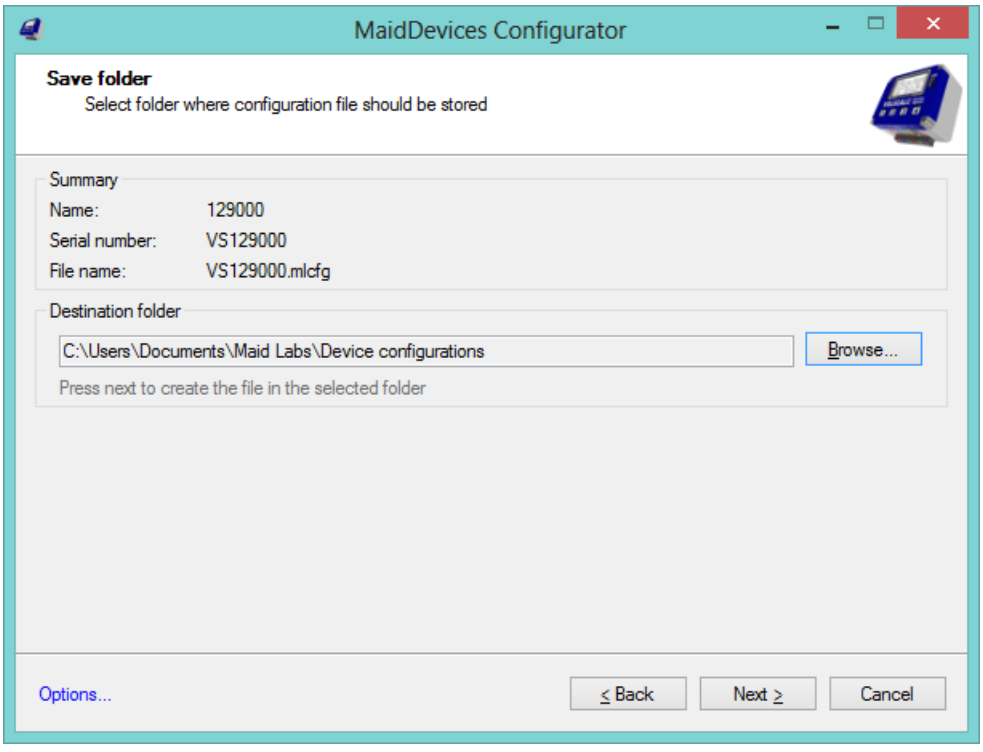
Save folder

The **Destination folder** shows where configuration files are usually saved, unless someone changed this. Click Browse... to select a different one.

To configure the Volucalc VS using the configuration file created with the MaidDevices Configurator, copy the configuration file on the root directory of a USB key.

Use a USB drive formatted with FAT16 or FAT32. The amount of files on the key influence the time to copy files.

Follow the USB instructions on page 29.



Accessories

Ultrasonic Level Sensor (MLSU-05M & MLSU-10M)

MAID Labs Technologies designed ultrasonic level sensors that are easy to install and does not require any special maintenance.

Ultrasonic level sensors MLSU-5M (0-5 meters) and MLSU-10M (0-10 meters) are high precision weatherproof sensors which can support temporary submersion (IP67), so it can go in or outside tanks.

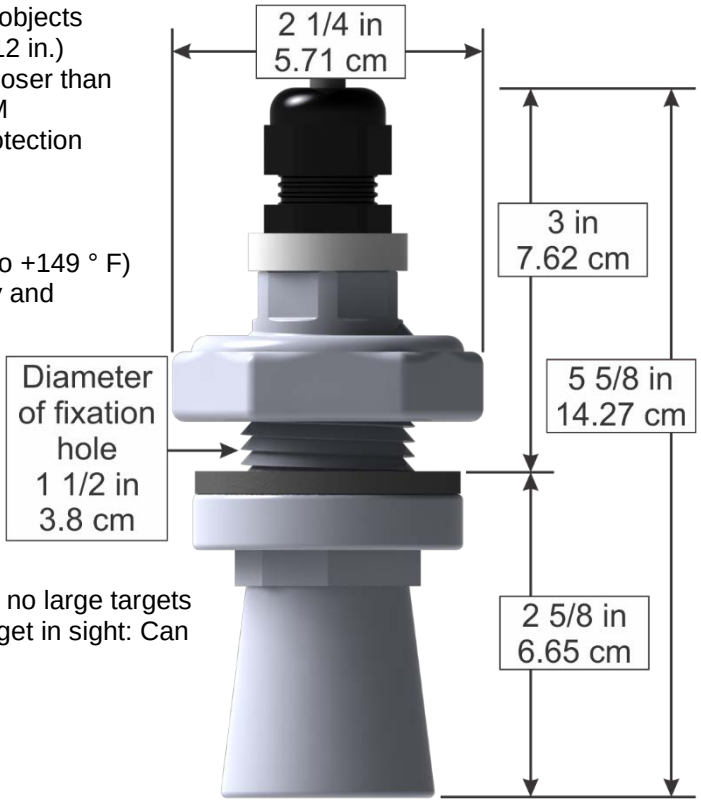
The probes are equipped with a firmware filter that allows it to ignore smaller targets and noise, and indicates the target that gives the greatest acoustic performance. The sensor also rejects the periodic noises that may have higher acoustic than the target. This gives users the flexibility for easy installation, even in obstructed and noisy places.

When target and object reflections are of similar size, preference is given to the nearest object.

The support bracket is optional.

Product Overview

- Maximum range of 5 meters (16 feet 4 inches) for MLUS-5M model
- Maximum range of 10 meters (32 feet 8 inches) for the MLUS-10M model
- Accuracy of 0.1% of the measuring range
- Read speed of 6.66Hz
- Internal temperature compensation
- 42kHz ultrasonic sensor measures the distance to objects
- Virtually no dead zone, objects closer than 30cm (12 in.) appear at 30cm on model MLUS-5M and objects closer than 50cm (20 in.) appear at 50cm on model MLUS-10M
- Power supply 9 to 30 VDC with reverse polarity protection
- 4-20 mA current consumption
- Small size
- Designed for easy integration into your project
- Operating temperature -40 ° C to +65 ° C (-40 ° F to +149 ° F)
- Automatic calibration in real time (voltage, humidity and ambient noise)
- Firmware filtering for excellent noise tolerance and rejection of obstructions
- Weatherproof (IP67 protected against the effects of immersion up to 1m)
- 1 ½ inch hole required for easy installation
- Detection area long and narrow
- Additional stability filter rejects abnormal readings
- Use the full dynamic range of the sensor, if there is no large targets present, the sensor will select the next smallest target in sight: Can be used to sort large objects behind smaller
- The best sensor for measuring tank level



Wastewater pressure level sensor (MLPL)

The Maid Labs wastewater level sensor is designed for indefinite immersion in a wide variety of liquid media. It is made of 316L Stainless Steel to resist aggressive media. It provides a temperature compensated analog output proportional to the height of the liquid above the sensor. It is intended for general applications for monitoring and control. This sensor is protected against lightning[3].

Accuracy	± 1 TEB[1]
Available Ranges	0-11 feet, 0-34.5 feet, and 0-231 feet
Compensated Temperature Range	0 to 50 ºC
Operating Temperature	-20 to 80 ºC
Analog Pressure Output	4-20 mA
Power Supply[2]	8-28 VDC
Load Resistance (Ω)	mA: <(Supply - 8V) / 0.02A
Wetted Materials	Standard 316L S.S., Polyamide, Fluorocarbon
Câble	Std. vented Polyethylene Optional Hytrel or Tefzel Diameter 0.23 in. / 5.8 mm
Sensor Dimensions	Length: 4.3 in. / 109 mm Diameter: 0.825 in. / 21 mm
Protection	IP68
Certification	CE

Notes

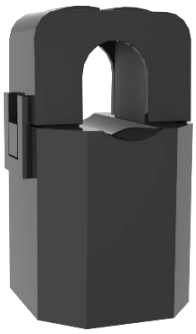
1. TEB: Total Error Band; Includes the combined effects of non-linearity, hysteresis and non-repeatability as well as thermal dependencies, over the compensated temperature range.
2. The ratings may be higher depending on the length of the cable. Cable resistance = ~ 70Ω / 1000ft.
3. For protection against lightning, shield wire should be connected to a good ground

Pump Outlet Pressure Sensor (MLPS50, MLPS100 and MLPS300)

The pressure sensors for 50 PSI (MLPS50), 100 PSI (MLPS100) and 300 PSI (MLPS300) are transmitters for general use for almost all applications involving aggressive fluids and where small size, weight and low cost are required. This proven design uses an isolated piezoresistive silicon sensor proven to be very reliable in thousands of applications around the world. Combined with a filtered electronic signal, the result is a robust sensor that will be trouble-free and provide accurate results.

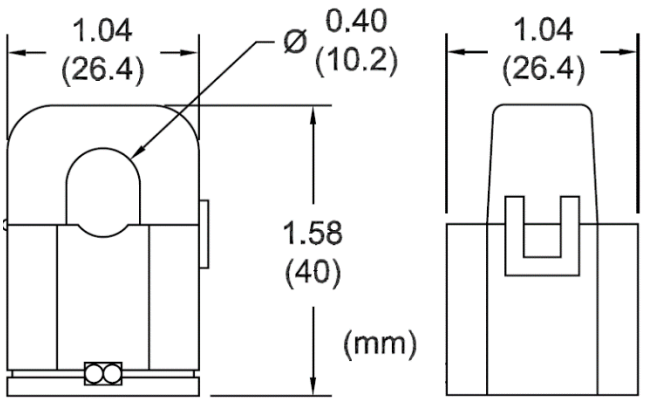
Accuracy	± 1% of range
Avalable Ranges	0-100 PSI and 0-300 PSI
Compensated Temperature Range	-0 à 50 ºC
Operating Temperature	-20 à 80 ºC
Analog Pressure Output	4-20 mA
Power Supply[2]	8-28 VDC
Connexion	1/4”-18NPT Male
Wetted Materials	Standard 316L S.S., Fluorocarbon
Câble	PVC
Sensor Dimensions	Length: 3.7 in. / 93 mm Diameter: 0.68 in. / 17mm
Protection	IP65
Certification	CE

Current Sensor (MLCT75)



The Split-core current transformer MLCT75 is designed to provide a low-cost method for monitoring electrical current. Its unique hinge pressure locking mechanism enables its installation without interrupting the current supply to the pumps or equipment.

For this model of sensor, the VS can be configured to enable a range of 0 to 15 amps and 0 to 75 amps, depending on the settings of the micro-switches (page 12).



Current Sensors (MLCT150 and MLCT300)

The current sensors MLCT150 (150 amps) and MLCT300 (300 amps) use the latest technology in current transformers. They are designed to meet the most stringent industry requirements. All models comply with the standards IEC1010-2-032, 600V, Cat. II.

These sensors have a jaw opening of 30 mm (1.19") and can accommodate wire of 29mm (1.15"). The unique jaw facilitates attachment to the wires.

They are made of polycarbonate and ultrasonically welded, in order to ensure their robustness and comprehensive and lasting reliability.

The use of wound cores improves the performance of high and low end. The accuracy of each model is optimized for its current range.

AC current probes for frequencies from 40Hz to 10kHz.

Index

$/kWh....27
0-10V....39
0-24V....39
0-5V....39
120 volts....37
240 volts....37
4-20 mA loop....38
4-20mA....39
AC....39
Accessories....7, 55
Advanced …....42
Alarm on the maximum value only....53
Alarm on the minimum and maximum values....53
Alarm on the minimum value only....53
Alarm out....53
Alarm output....39
Alarm type....20
Alarms....20, 24, 53
Alarms Report....28
Alternate....38
AMP....38
Analog....19
Analog input....17
Analog output test....26
Assert....24
Average Outflow....27, 31
Average voltage....37
Bandwidth....16, 20, 39
Bandwidth setup....20
Batteries....35
Battery Operation....35
Bottom width....49
Brightness....17
Cable disconnected....25
Calibration worksheet....46
California Pipe....52
Capteur de courant....58
Cipoletti....48
Cleaning....9
Clock....35
Communication....13, 54
Communication setup....53
Communication test....25
Computed Level....19
Contacts....7
Contracted Rectangular weir....48
Copy App from USB....24
Copy Manual from USB....24
Copy software....21
Copy User Manual....32
Cost per kWh....37
Create a new file....33
Create from an existing file....33
Crest length of weir....48
CSV format....29
Current Pump 1 P1....18
Current Pump 2 P1....18
Current Sensor....58
Current Transformer....38
Current. Outflow....27
Custom sensor....17, 18, 19
Date & Time....16
Daylight saving time....35
DC....39
Delay before alarm is generated....53
Delete File....24
Destination folder....54
Device Details....34
Device info....25
Device Info....34
Device Name....35
DevicesMAID Configurator....25
Digital....19, 24
Digital input....13, 17, 28
Digital out....39
Digital output....53
Dimensions....8
Display....17
Display Brightness....35
Display options....35, 42
Download settings....21
EE-400....33
Electrical Conditions....9
Electricity....37
energy efficiency....36
Environmental Conditions....9
Estimation....44
Ethernet....39, 53
Ethernet buffer....24
Events Reports....28
Excel....14, 29, 46
External flow (measured)....36
Factory Reset....21, 24
Firmware upgrade....21
Fixed level....45
Fixed pressure....45
Fixed pump capacities....36
Fixed speed....36
Fixed speed pump capacity....39
Float....39
Flow....13, 17, 26, 28, 37, 39, 40, 43, 52
Flow accuracy....46
Flow algorithm....36
Flow computation formulas....47
FlowMaid....33
Functions....39
General....34, 53
General informations....35

Generate an alarm below 53
Global 36
Greenwich Mean Time (GMT) 35
Hardware I/O 38
Head 26
Head adjustment 45
High level 39
Http 24
I/O 38, 39
Impeller diameter 42
Info 14, 28
Initial curve speed 42
Input configuration 38
Inputs and Outputs 37, 53
Inputs Calibration 24
Inputs/Outputs 17
Installation 9
Instrument setup 15
Instrument start-up 13
Internal Info 27
International units 34
Internet 35, 39
Intrusion 39
IP Informations 25
Jumpers 9, 39
Language 22, 34
Level 13, 20, 24, 26, 39, 52
Level adjustment 45
Level Input 19
Level options 45
Level Override 23
Level setup 19, 47
Lift station 36, 40
Lock screen 26
Lock screen password 22
Lookup table 52
Magnetic flowmeter 36
MaidDevices Configurator 33
Main Screen 13
Maintenance 9
Manage pumps curves 44
Manning 50
Manning Coefficient 49, 50
Manning Equation (Open channel) 49
Manning Equation (Partially full pipe) 50
Manual control 39
Measured in delta 37
Measured outflow 19
Menu 13, 15
MerMaid analysis software 33
MerMaid Data 32
Metric units 34
Micro switches 10
MLCT150 58
MLCT300 58
MLCT75 58
MLPS100 57
MLPS300 57
MLPS50 57
Month 28
Monthly Events 29, 30
Monthly Overflow 29, 30
Monthly reports 29
Monthly Volucalc VS 29, 31
Multiple devices 35
Number of pumps 36
Number selection screen 14
Offline 54
Open an existing file 33
Open Channel Flow 19, 20, 47, 49
Options 7, 33, 34, 38, 42
Output pressure options 45
Overflow 24, 28, 39, 54
Overflow Computation 20
Overflow level 20, 47
Overflow setup 19
Overflow volume 39
P1 to P4 26
Palmer-Bowlus 51
Parshall 51
Password 36
Phases 37
Phases Setup 23
Pipe diameter 50, 52
Pipe slope 49, 50
Polynomial Flow Formula 51
Power Consumption 27
Power factor 37
Power Factor Setup 22
Power source 35
Power supply 9
Pressure 14, 26, 39
Pressure at the inlet of a pump 39
Pressure Input 19
Pressure Override 23
PressureMaid 33
Product Application 7
Product Description 7
Pump Curve Editor 42, 43
Pump Curve Selection 40
Pump curves 36, 41, 42
Pump Curves Setup 42
Pump Outlet Pressure Sensor 57
Pump Statistics 27
Pumped volume 39
Pumps 44
Pumps capacities 40
Rain 14, 28, 39
Rain Statistics 28
Range 37, 39
Raw Values 24
Read all phases 37

Read conf. file....21
Real Level....19
Real Time....14, 26
Regional Settings....35
Registration....3
Relay test....25
Remote....20
Remote control....39
Reports....29
Reset....27
Reset total events....21
RPM....18, 27, 38, 43
RT....26
Run time....27
Save folder....54
Screen Password....22
Screen Reports....28
ScreenShot....24
SD Card Info....24
Send data after important changes....54
Send data files....54
Send Maid Maps data....54
Serial number....25, 34
Share curves for all pumps....40
Shutdown device....26
Side angle....49
Software upgrade....21
Speed....39, 44
Speed input....38
Standard Flow Formula....51
Standard time....35
Starts....27
Successful Communication....25
Sump pump....39
Suppressed rectangular weir....48
System curve....46
Table of contents....5
Technician....23
Technician Data....32
TempBatt....24
The device is connected to the Internet....53
Time Zone....35
Total power usage....37
Total volume....27
TR....14
Trapezoidal Weir....48
Ultrasonic Level Sensor....55
United States units....34
Units....16, 34
Universal Time Coordinated (UTC)....35
USB....14, 29, 54
Use alternate server....54
V angle....49
V Notch Weir....49
Value at 1.5v....18
Value at 20 mA....18, 38
Value at 4 mA....17, 38
Variable frequency drives....38
Variable speed....36
Variable speed pumps....41
VCC....39
Voltage....39
Voltage Setup....22
Volucalc RT....36
Volucalc VS installation....12
volucalcvs.hex....21
Volume....13, 28
Volume in....39
Volumetric....36
Warranty....4
Wastewater pressure level sensor....56
Water pressure....39
Web server....53
Weirs....47
Welcome Window....33
www.maidlabs.com....21
WYE....22
Year....28
Zero level....19, 47

Maid Labs Technologies

944 André-Liné street, Granby, Quebec Canada J2J 1E2

www.maidlabs.com 450-375-2144 info@maidlabs.com